SCIENCE

A WEEKLY JOURNAL DEVOTED TO THE ADVANCEMENT OF SCIENCE, PUBLISHING THE OFFICIAL NOTICES AND PROCEEDINGS OF THE AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE.

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FRIDAY, DECEMBER 20, 1901.

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MSS. intended for publication and books, etc., intended for review should be sent to the responsible editor, Professor J. McKeen Cattell, Garrison-on-Hudson, N. Y.

THE NAVAL OBSERVATORY REPORT.

No excuse is necessary for devoting the space we do to this important paper in our present number. We include with it only such portions of the reports of departments as seem to be of general interest. Among these is the very business-like report of the National Almanac Office.

Readers who have followed the discussions of the organization of the observatory which have appeared in our columns during the past year will be interested in this branch of the subject. We trust they will bear with us if we describe the spirit in which we have endeavored to carry on the discussion. We have taken as a fundamental principle that our remarks should be based on official publications and that no heed should be given either to gossip about the interior affairs of the observatory, which circulates so freely, or to supposed leaks through unofficial channels.

The case as thus presented has seemed to us too serious to admit of our indulging in carping, fault-finding or minor criticisms, even had we been disposed to do so. As presented in the report of the board of visitors for 1900 it took the following form: Our government has for more than half

a century been supporting a great national observatory for the promotion of astronomical science. During the last few years this has been done at a cost exceeding that of any other observatory, public or private, in the world. Even the great observatories of Greenwich and Paris, which the two governments have supported in friendly rivalry, do not approach ours in the matter of outlay.

The latter has, at various times during the past twenty years, been reported upon, officially and unofficially, by the highest scientific authorities in the land. Only one voice is heard in these reports. The work of our observatory, considered as a whole, does not come up to any standard of which our country can be proud. The Greenwich and Paris observatories are the pride of their respective nations; ours can inspire no such sentiment. On the cause of this failure the expressions are also unanimous. No reflection is ever heard upon the staff of the institution, which has always been and still is of the ablest. But this alone does not fulfil all the requirements of success. The best instruments and a well-arranged plan of work are also necessary. Above all, the work must be directed with that familiarity with the multifarious details of modern astronomy which our own good sense, as well as the experience and practice of all other nations, show to be necessary to success.

Secretaries of the navy have joined their voices with those of the scientific authorities in calling attention to this want, and asking that it be supplied. But Congress has never made provision for a director of the observatory, and the work has suffered, and still suffers, in consequence.

Desirous of seeing to what extent the observatory had replied to all these criticisms, we made a careful study of its reports during the last ten years. It required no knowledge of technical astronomy to see that the most serious strictures seemed to be amply justified by them. Especially striking was the defense of the observatory in the report for 1900. A number of alleged weak points were pointed out in the report of the board of visitors, but the serious criticism was ignored, unless an implied denunciation of the whole body of astronomers of established reputation as men 'whose prejudices and animosities were mature and confirmed' could be regarded as a reply.

In our issue of January 4 last, we set forth the main points of the case against the observatory and earnestly invited their consideration by official authority. Our readers will be gratified to see that the head of the observatory has not thought them unworthy of attention. Desiring, as we do, in the interest of fairness and justice, to give the greatest publicity possible to every official defense of the scientific character of the institution, we invite attention to the following passages of the report, premising that we do not imply that this is or is intended to be the best that the author of the passages might say on the subject:

> Critics who are in no way responsible for results, and who probably would not carry out their own suggestions if they were, have had a standing grievance against the observatory because it has not put its clocks underground. In point of fact very few

observatories do put their clocks underground. The notable exception is Pulkova.

I invite the attention of the Bureau to Mr. Hill's report, as evidence of the spirit in which the observatory has been (and still is) criticized by outside astronomers. Malice has dictated these criticisms, to my knowledge, for thirty years. In this instance ignorance becomes a valuable accessory.

Leniency in criticism of the quality of the work thus issued is not asked nor expected. Scientific work must stand or fall on its merits. But it would be an encouragement, little to be expected, if the scientific world of this country could appreciate or acknowledge the efforts to bring up to date work long in arrears. Appreciation from abroad is not wanting, and has been gratefully acknowledged.

The passage alluded to in the second extract is the following:

Before proceeding to report upon the observations secured with the instruments I desire to invite the attention of the superintendent to the following extract from SCIENCE for January 11, 1901, page 42:

We find, also, that the total number of separate observations with the prime vertical transit was 164, less than one-half the number of nights in the year, while those with the altazimuth, used as a zenith telescope, numbered a little more than the days in the year. At the international geodetic stations the observers are expected to make about 16 double observations on every clear night.

Attention is also invited to this extract from the same publication, but of the date of January 4, 1901, page 4:

There are also intimations that something is wrong with the prime vertical transit, and altogether the impression made on the reader is that, after seven years of effort to equip the observatory with the best instruments, it is doubtful whether a single one of real importance, except the great telescope, is in order for first-class work.

The writer of these editorials in SCIENCE clearly indicates that his conceptions of the amount of astronomical observing to be obtained with an instrument in the prime vertical are absurd.

This betrays a misconception so singular that we must correct it. In our strictures of want of continuity we expressly excepted the work with the prime vertical transit, which has been pursued with rare zeal and diligence. The passage first quoted from our columns was intended only to show the difficulty that readers might feel in reconciling it with the following striking statement in the report for 1900, which was given a place of honor both there and in the report of the Bureau:

All the astronomical instruments of the observatory have been steadily and continuously in use during the year on every clear night and day.

In energetically showing that the instrument was out of use from April till June, Mr. Hill only impugns the accuracy of this statement, not the correctness of our remarks, which were mere condensations from the observatory report.

The intimations of our second extract comprised allusions to 'a systematic error whose origin still remains a mystery,' and reported efforts to locate this error found in the publications and reports of the observatory. Our 'grave doubts' may be justified by the facts now reported that three other instruments have been undergoing alterations and repairs since we wrote.

A statement has appeared in the public prints that the head of the observatory will reply to the board of visitors. If this is done SCIENCE will be glad, in the interest of fairness and justice, to bring into prominence whatever he can say in defense of his position.

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*REPORT OF THE SUPERINTENDENT OF THE NAVAL OBSERVATORY.**

THE 26-INCH EQUATORIAL TELESCOPE.

THIS instrument has been in charge of Professor T. J. J. See during the whole year. Owing to the death of Mr. George

* Condensed by omitting passages of less general interest than the rest.—EDITOR.

Anderson, who had been assistant on this instrument for twenty-six years, which occurred in November last, and to the absence after February 1 of the party sent out by the observatory to observe the eclipse of the sun in Sumatra, Professor See worked entirely alone for a part of the year. The manual labor alone in using this instrument is considerable, and I consider the showing made in Professor See's report as creditable. This instrument has been devoted to the same general line of work as in previous years, and has been maintained in good order. Professor See's report is herewith transmitted.

THE 9-INCH TRANSIT CIRCLE.

This instrument has been steadily employed on the regular sun, moon, and planet work, a revision of the Astronomische Gesellschaft Zones, and the Zone of Zodiacal Stars undertaken for the Paris Astronomical Conference of 1896. From long service this instrument is in need of important repairs. The pivots have become so worn as to need regrinding, and the illumination should be changed so that the reticule will be illuminated by a beam of light in the optical axis of the instrument, instead of a beam cast from one side, as at present. As soon as the alterations of the 6-inch transit circle, which are noted later, are completed, the whole staff for meridian observations will be transferred to that instrument, and the 9-inch transit circle will be put under repairs. The report of Assistant Astronomer King, in charge of the instrument at the close of the fiscal year, is transmitted herewith.

THE 6-INCH TRANSIT CIRCLE.

Since this instrument was mounted two years ago a serious defect in the form of a diurnal change in the constant of azimuth, following changes of temperature, has been a source of annoyance and embarrassment and a serious detriment to the usefulness of the instrument. Since March last a systematic and patient investigation of this defect has been carried on by Professor Updegraff with the object of determining, and if possible, removing the cause. Successive changes have been made in the instrument and its supports as a result of this investigation, without in any way altering its form (which could not be done without entirely rebuilding it), and there is reason to believe that the success of these changes is already assured.

This instrument was built by Messrs. Warner & Swasey, of Cleveland, Ohio, from designs by Professor William Harkness, U. S. N., following closely the pattern of the latest instruments by Repsold, of Hamburg. It would be presumptuous to criticise the result of the experience of the oldest and most skilful instrument-makers in the world, and yet I can not believe that this form of instrument will ever be entirely free from uncertainty in the errors of azimuth or level, or both, for the reason that in order to assure precision in other respects a principle has been sacrificed which has been recognized as fundamental in the construction of astronomical instruments for at least two hundred years, viz., that the instrument itself should be directly supported on a substantial foundation of masonry. In this form of instrument the pivots are supported by a skeleton work of metal by which they are raised sixteen inches above the piers. Differences in the rate of expansion between the masonry of the piers and the metal support of the pivots become immediately apparent in the azimuth or level of the instrument, and some evidence of this will, I believe, be always apparent. If these errors can be reduced to something manageable under normal conditions, there will still remain the probability that abnormal conditions and sudden and excessive changes of temperature may still make them incon-

veniently apparent. In this connection I may observe that preparations have been made for a south meridian mark for both the 6-inch and 9-inch meridian circles, but no steps have been taken during the year to erect them.

THE CLOCK SYSTEM.

The effort to bring the department of meridian observations, which is the real *raison d'être* of the Observatory itself, to a state of the highest efficiency and up to the most modern standard of requirement, has included not only a thorough overhauling of both meridian instruments, but also an examination, and if possible an improvement in the clock system of the Observatory. Critics who are in no way responsible for results, and who probably would not carry out their own suggestions if they were, have had a standing grievance against the Observatory because it has not put its clocks underground. In point of fact very few observatories do put their clocks underground. The notable exception is Pulkova. It is difficult to maintain a clock underground and not ruin it by rust. The experiment was tried in the very early days of the Naval Observatory and abandoned after the valuable Kessels clock had been nearly sacrificed to the experiment. If, however, a clock can be inclosed in air-tight case from which the air has been partially exhausted, it should be entirely removed from the influences of temperature, pressure and humidity, and it should, theoretically, be as safe in a vault as above ground. This is the principle which has governed the construction of the clock vault of the Naval Observatory. The vault is dug in the basement of the clock house, which stands on the highest eminence in the Observatory grounds, a knoll of quite abrupt grades, of a gravel soil, and so situated that the natural drainage is away from the vault in all directions. The vault is built with double walls and roof and thick concrete floor, the space between the walls being filled with nonconducting material. The air of the vault is dried by gas and proper provision is made for ventilation. The air-tight cases containing the clocks are of metal and glass, and in each is exposed in full view a rust gauge of bright steel, which is closely watched, and its condition reported to the Superintendent at frequent intervals. The Kessels clock, which is regarded as the standard, is regulated to mean time, and as it is not capable of sustaining the electrical connections necessary for chronometric connection on the clock circuit, it is compared with the sidereal sounder by coincidence of beats by the aid of a microphone, the beats of the clock being wholly inaudible to the unaided ear. So far the whole arrangement has proved on the whole satisfactory, and the rate of the Kessels clock reduced to a constant of almost 0. Some trouble has been experienced in making the clock case actually air-tight, and if the experiment (for I regard it as no more than an experiment) fails, it will be from this cause. Professor Updegraff's report is herewith transmitted.

THE 12-INCH EQUATORIAL.

This instrument has undergone extensive alterations during the year. It was remounted in April, and has been employed in charge of Assistant Astronomer Theo. I. King, since that time. This instrument is used for the benefit of visitors admitted to the Observatory at night.

THE PRIME VERTICAL TRANSIT INSTRUMENT AND 5-INCH ALTAZIMUTH.

These instruments have remained in charge of Assistant Astronomer G. A. Hill, in continuation of the observations for variation of latitude.

I invite the attention of the Bureau to Mr. Hill's report, as evidence of the spirit in which the Observatory has been (and

still is) criticised by outside astronomers. Malice has dictated these criticisms, to my knowledge, for thirty years. In this instance ignorance becomes a valuable accessory.

THE 40-FOOT PHOTO-HELIOGRAPH.

Photographs have been taken of the sun daily whenever the weather and other circumstances would permit. During the absence of the photographer, Mr. George H. Peters, on duty with the eclipse expedition, his place was supplied by Mr. E. A. Boeger, computer.

THE TOTAL SOLAR ECLIPSE OF MAY 18, 1901.

By virtue of a provision of the urgency deficiency bill of the last session of Congress, the Observatory was enabled to equip and put in the field an expedition to the island of Sumatra to observe the total eclipse of the sun of May 18, under charge of Professor A. N. Skinner, U. S. N. Professor Skinner's very interesting preliminary report of the expedition and its results is forwarded herewith. A detailed report will appear in conjunction with a report of the eclipse of May 28, 1900, in a forthcoming volume.

It may very reasonably be asked whether, in view of the meager results on account of cloudy weather on the day of the eclipse, the expense of sending an expedition to such a distance was a justifiable outlay of public money. The reply would be that a chance of failure on account of the weather was one of the conditions which attached unavoidably to the undertaking. Other expeditions were less fortunate and secured no results at all. But the real answer is that results, no matter how meager, fully justify the outlay, because such results are not to be judged by themselves, but are to be regarded as forming a part of the general sum of observations of this and other eclipses. The problems presented will be solved, not by the recorded observations of any one person at any one time, but by the accumulation of such observations in the general account of human knowledge. From this point of view even one photograph, or a single observation of contact, would have fully justified the entire outlay. At Fort de Kock ten excellent negatives were obtained, which were acknowledged by foreign astronomers to be the best made by any party in the field, and at Solok, the Observatory's other station, contacts were observed and some photographs obtained. I am satisfied with the results.

A serious drawback to the expedition has been the withdrawal for so long a period of an important part of the Observatory's astronomical staff.

An acknowledgement is due the War Department for uniform courtesy to the expedition both on board the transports and at Manila, and to the commanding officer of the U. S. S. *General Alava* for much valuable assistance.

COMPUTATIONS AND PUBLICATIONS.

Since my last report the whole computing force of the Observatory has been assembled in one division, instead of being distributed to the various instruments as heretofore. This change has resulted in a decided economy of time and labor, and is generally in the interests of system and efficiency. All astronomical observations, by whomsoever made, are turned over to the computing division for reduction, it being understood that the author is consulted as to the methods of reduction and exercises a general supervision in cooperation with the officers at the head of the division. Professor Eichelberger has been placed in charge of this division, and in his absence with the Sumatra eclipse expedition his place was supplied by Assistant Astronomer King, up to the close of the fiscal year.

During the year the first volume of the new series of Washington Observations has

been published and distributed. The second volume is ready for the press and will be printed immediately. A third volume is nearly ready, and other volumes will follow as rapidly as the material can be prepared for the printer, and until the accumulation of unpublished work is exhausted. This breaks the long suspension of printing which has been a source of anxiety for several years. Leniency in criticism of the quality of the work thus issued is not asked nor expected. Scientific work must stand or fail on its merits. But it would be an encouragement, little to be expected, if the scientific world of this country could appreciate or acknowledge the efforts to bring up to date work long in arrears. Appreciation from abroad is not wanting, and has been gratefully acknowledged.

NAUTICAL ALMANAC OFFICE.

Professor W. S. Harshman was appointed Director of the Nautical Almanac March 28, 1901. Up to that time and since the retirement of Professor Simon Newcomb the direction had been in the hands of a professor of mathematics who held the post in addition to his regular duties at the Observatory. The Almanac demands the undivided time and attention of a competent director. This need had become imperative. Professor Harshman has had the advantage of long experience in the office in a subordinate capacity. He has systematized and regulated the office and brought the work up to date, the regular issue of the Almanac three years in advance having failed. The office is now in a high state of efficiency, and general harmony and enthusiasm prevail in its staff. The Nautical Almanac has been noted, since its foundation in 1849, for thoroughness and precision in its methods and for superior excellence in its personnel. That this quality is still dominant is shown by the high stand taken by several of its staff in the competitive examinations for professorships. The report of the Director of the Nautical Almanac is herewith transmitted.

THE BOARD OF VISITORS.

The Board of Visitors established by the naval appropriation act approved March 3, 1901, which went into effect on July 1, met in April, and since that time and prior to July 1, two duly constituted committees of the board have visited the Observatory officially. The law provides for one 'annual visitation to the Observatory at a date to be determined by the Secretary of the Navy, and * * * such other visitations, not exceeding two in number annually, by the full board or by a duly appointed committee as may be deemed needful or expedient by the majority of the board.' The board has already made the full number of visits allowed by law to any one year.

THE DEPARTMENT OF NAUTICAL INSTRUMENTS AND GENERAL STORE-KEEPER AND DEPARTMENT OF CHRONOMETERS AND TIME SERVICE.

By the detachment of Lieut. Commander Charles E. Fox in May, the last remaining officer of these departments was withdrawn, and both of these important departments left without any regularly assigned personnel whatever. The regulations for the government of the Observatory issued by the Department provide for three officers for this work. I believe this situation is unique in the public service. It is hard to make bricks without straw, but that is the situation of these departments at the present time.

As the work could not cease, a computer, previously detailed from the astronomical department has been put in charge of these departments, with one of the clerks of the Observatory in charge of the books. This arrangement is not only improper, but is prejudicial to the service and injurious to

the individual. I have in previous reports made specific recommendations looking to the establishment and maintenance of a permanent force for these departments. I renew these recommendations. The accompanying reports show the volume of business in these departments for the year.

THE PRIME VERTICAL TRANSIT AND THE ALTAZIMUTH.

Sir: In compliance with paragraph twenty three of the regulations governing the United States Naval Observatory, I respectfully submit the following report of the operations in my department during the year ending June 30, 1901.

Before proceeding to report upon the observations secured with the instruments I desire to invite the attention of the superintendent to the following extract from SCIENCE for January 11, 1901, page 42:

"We find, also, that the total number of separate observations with the prime vertical transit was 164, less than one-half the number of nights in the year, while those with the altazimuth, used as a zenith telescope, numbered a little more than the days in the year. At the international geodetic stations the observers are expected to make about sixteen double observations on every clear night."

Attention is also invited to this extract from the same publication, but of date January 4, 1901, page 4:

"There are also intimations that something is wrong with the prime vertical transit, and altogether the impression made on the reader is that, after seven years of effort to equip the observatory with the best instruments, it is doubtful whether a single one of real importance, except the great telescope, is in order for first-class work."

The writer of these editorials in SCIENCE clearly indicates that his conceptions of the amount of astronomical observing to be obtained with an instrument in the prime vertical are absurd.

Taking up the first extract, I wish to answer it. I was, by orders of the Department, as well as by yourself, detailed last spring as an observer in one of the parties sent south to observe the eclipse of the sun, and for six weeks I was detached from the instrument.

From April 15 to May 1, I was directed to give my whole time to preparing for shipment the apparatus to be used in the eclipse. From May 1 until June 1, 1900, I was at Griffin and Barnesville, Ga., engaged in preparing for the phenomena just mentioned. In addition, I observed at both places on fifteen nights, to determine their latitude and longitude.

The wisdom of the Observatory displayed in having those two fundamental positions determined is well illustrated by the misfortune that came to an observer who went to Africa. He trusted to an approximate latitude and longitude, and found at the instant of the eclipse he was entirely outside of the shadow line.

If the writer of the above extract was only superficially informed of the time necessary to secure a complete observation of a star across the prime vertical, he would not have attempted to make a comparison between the number of observations secured during the same period with the prime vertical and the zenith telescope. It will take about four hours per night to observe sixteen pairs of stars with the zenith telescope, the number usually obtained by those engaged in the variation of latitude work. In the same time it is impossible for anyone using the prime vertical to secure more than four or five, and had the writer consulted an astronomer he would have found that out.

During the past spring I observed practically all night on each in which the sky was clear, and over a tour of observing of

nine or ten hours the largest number of star observations I could possibly obtain was nine or ten.

As an additional answer to his senseless criticism, I would invite the attention of the superintendent to a comparison of the number of observations made with our instrument with that obtained by the only other astronomer who is now continuously observing with the prime vertical transit.

In 1900 I obtained in ten and one-half months observing 164 observations. The observer at Pulkova for the full year made 106. Since 1896 I have secured 1,150 observations. In the same time the prime vertical at Pulkova has yielded 755. This record will be found in Professor Albrecht's report on the variation of latitude for 1900, a copy of which is in the library.

The remarks contained in the second extract are equally absurd.

In justice to our prime vertical transit, I desire here to state that it is of a better form, it is built in a more symmetrical manner, and its mounting permits of determining the errors it may have in a more complete manner than any other now in use.

In 1898 I obtained about 125 observations of α Lyræ in the full daylight, as well as in the night. The range between the greatest and least declination for the whole year's work, including every observation made, and the good, fair, and poor seeing that obtained for each, was 1.44″. If four observations are rejected, because they stand out so markedly from the others, made at a time when the seeing was very poor, and so noted in the observing book, the range is reduced to 1.04″.

There is not in existence a meridian circle, vertical circle or zenith telescope that has been used to observe the same star or pair of stars, *throughout the year*, that has as small a range as that in the declination, or latitude secured with it. The probable error of a single observation for that series, including the variation of latitude, is ± 0.16″.

I have during the year made an investigation of the form of the two pivots attached to the instrument. I have examined each throughout the length of its bearing surface in the Y's, and the results, which will be printed in the volume containing the observations secured with the instrument, do not indicate that either pivot is out of parallelism with the cube, or that their departure from a true cylinder is of enough magnitude to affect an observation.

In the past year I have made 619 observations with the aid of both instruments. The reduction of the observations on the sheets, which have all been made by myself, are practically complete to the 1st of January, 1901.

Last fall I made a complete rediscussion of the prime vertical transit observations, basing the derived latitude upon the star places obtained from the New Catalogue of Fundamental Stars, prepared by Professor S. Newcomb. After it was finished the results were transmitted to Professor Albrecht, of the Central Bureau der Internationalen Erdmessung, Potsdam, Germany, to be used by him in his annual paper upon the 'Variation of Latitude.'

From that discussion the following mean yearly latitudes were obtained:

	°	′	″
1894	38	55	14.51
1895			.52
1896			.61
1897			.46
1898			.45
1899			.43
1900			.55
Mean	38	55	14.50
Reduction to the clock room			—.52
Latitude of Naval Observatory	38	55	13.98

The individual observations of all prime vertical transits up to December 31, 1899, are now ready for the printer. The intro-

duction to the volume to contain them is three-fourths completed, and will be finished in time to transmit it to the Government Printing Office by the last of July or middle of August.

The 5-inch altazimuth was used during the year principally as a zenith telescope, in connection with the prime vertical transit. I am not making zenith-telescope observations exclusively with it, but only of those stars that are observed with the prime vertical, and which permit of being observed by Talcott's method.

This observatory is the only one in this country equipped with a prime vertical transit and for that very reason the major portion of the data we are securing for the study of the variation of latitude is made with it.

George A. Hill,
Assistant Astronomer.

ANNUAL REPORT OF THE SECRETARY OF AGRICULTURE, 1901.

The Fifth Annual Report of the Secretary of Agriculture, Hon. James Wilson, is considerably longer than in former years, reflecting thereby the great growth and development which has attended this Department during his administration.

WEATHER BUREAU.

He announces an important extension of the forecast field of the Weather Bureau, which now includes reports from certain points in the British Isles and on the continent of Europe, from the Azores, Nassau, Bermuda and Turks' Island. The Atlantic forecasts based upon these reports now form part of the regular night forecasts issued in Washington. Three new forecast districts have been established—in Boston, New Orleans and Denmark. An extension of the forecast to farmers through the Rural Free Delivery is contemplated. Substantial improvements are reported in the Department's system of wireless telegraphy, of which the Secretary states in conclusion:

> While there is much experimental work yet to be done before the present system is reliable for intership communication, or before any two systems can work within the same field without each rendering the other useless, such progress has been made by the Government experimenters that, with no interference by private systems, stations can be successfully operated over at least 150 miles of coast line, and they are now in operation on the North Carolina and Virginia coasts, and soon will be instituted between the Farallone Islands and the mainland and Tatoosh Island and the mainland, on the Pacific coast.

ANIMAL INDUSTRY.

A large portion of the report covers the subject of animal industry. The grand total of animals and animal products exported during the year exceeded $250,000,000 in value. This vast foreign market is only preserved to our producers by the indefatigable efforts of the Department and the rigid inspection exercised through the Bureau of Animal Industry. This Bureau inspected for export 385,000 cattle, 228,000 sheep and 48,000 horses and mules, and nearly 1,000 vessels carrying live-stock. Imported animals were also inspected to the number of 342,000, and, where necessary, quarantined. The Secretary suggests that with the enormous interests our stock-raisers have at stake, and inspection or quarantine affording, after all, a relative, not an absolute guarantee of protection, it might be well for this country to follow the example of Great Britain and exclude live-stock from other countries entirely. The meat-inspection service involved the inspection at time of slaughter of nearly 37,000,000 animals. Of the more than 5,000,000 cattle inspected, the condemned carcasses were about one-fourth of 1 per cent.; of the 6,500,000 sheep, one-tenth of 1 per cent.; and of 24,000,000 hogs, one-third of 1 per cent. In the control of indigenous diseases, 1,500,000 inspections were made and over 45,000 cars disinfected in the Texas fever

service alone. In the repression of scabies in sheep nearly 8,000,000 animals were inspected and over 1,000,000 dipped under the supervision of the Department inspectors. In combating the disease known as 'black leg' the Bureau distributed over 1,500,000 doses of vaccine, the result being to reduce losses in affected herds to less than 1 per cent., where formerly it was in most cases about 10 per cent. To aid in detecting tuberculosis in cattle and glanders in horses, over 44,000 doses of tuberculin and 7,000 doses of mallein have been supplied. The Secretary points out the serious evil resulting from a system of State inspection, which, if it became general, would effectually prevent the marketing of live-stock in some sections, and would destroy much of the usefulness of the Federal inspection. He regards the present conditions as so menacing to the interests of the cattle industry in the West and Southwest, that he has requested the Attorney-General to cooperate in bringing the matter before the Supreme Court for decision as to the constitutionality of these State laws. This request has been favorably received and the assistance of the Department of Justice promised.

PLANT INDUSTRY.

The organization of the Bureau of Plant Industry is reported. It has brought together in one group investigations in plant physiology and pathology, botany, grasses and forage plants, pomology, and the experimental gardens and grounds including the experimental farm at Arlington, and the introduction of foreign seeds and plants.

Plant Physiology and Pathology.—Investigations in plant physiology and pathology have been lately devoted to the study of cotton diseases, diseases of orchard fruits, and of forest trees and construction timber. An interesting discovery to cotton-growers is reported of a cowpea resistant to the fungus that destroys the cotton roots. The cowpea being used in rotation with cotton, the securing a resistant cowpea will be of the greatest possible value to cotton-growers. Remarkable success is reported in experiments in plant-breeding to secure samples of cotton resistant to wilt and other diseases. Numerous valuable hybrids have also been developed. One from an American upland cotton and an Egyptian variety promises to be greatly superior to either parent. The Department has been for several years trying to secure by breeding a race of oranges resistant to frost. A cross of hardy Japanese with the Florida sweet orange has resulted in the hardiest evergreen orange known, and there is promise of ultimately securing a fruit both hardy and of good quality. Considerable success has also been attained in breeding raisin grapes resistant to the disease known as 'coulure.'

Botanical Investigations.—In botanical investigations important work has been done on seeds, improvement of crops, and methods of crop production in our tropical possessions, and prevention of losses to cattle in the West from eating poisonous plants. The low germination of commercial samples of Kentucky blue-grass seed was investigated. It was found that there is a stage in harvesting this seed when heating takes place in the tops of the grass, piled in windrows, which tends to destroy the germination of the seed. This can be avoided by methods of handling the grass, but the Department is experimenting with machinery which will dry the moist seed without permitting it to heat. Comparative experiments regarding the relative value of American and European clover seed give results strongly in favor of the former, at least under conditions prevalent in this country. A remedy has been found which, when promptly administered, is effectual in the treatment of animals poisoned from larkspur and poison camas.

The agricultural conditions of our new possessions are being thoroughly studied, and special attention is being given to the production in these possessions of tropical crops, for which the United States pays out millions of dollars annually. Raising coffee in Porto Rico has been the subject of special study. Our annual importations of this valuable crop now amount to $70,000,000. The Secretary asserts that much loss has resulted to the cattle industry in the West in recent years, owing to the injudicious management of ranges. The Department's experiments show that much could be done, under proper control, to restore the ranges to their original condition, and he recommends action by Congress, giving the President authority to secure for the experimental needs of his Department such tracts of public range lands as may be necessary.

Pomological Investigations.—The pomological investigations have been especially directed to the extension of the fruit markets abroad and to the encouragement of the domestic production of fruits hitherto largely imported. Prune-growing has been made the subject of special study; also the growing of European grapes in the South. Attention is called to the rapid increase in our exports of apples since the magnificent showing of this fruit made by this Department at the Paris Exposition.

Arlington Farm—Tea Experiments.—Progress is reported in preparing the Arlington farm to serve in conducting experiments, as an adjunct to the Department. The Secretary cordially commends the experimental work now carried on at Summerville, S. C., under the direct supervision of Dr. C. U. Shepherd. About 4,500 pounds of high-grade tea, which found a ready market, were produced here during the year.

Introduction of Valuable Seeds and Plants.—Great activity has characterized the introduction of valuable seeds and plants from abroad, with most satisfactory results. The development of the rice industry in Louisiana and Texas since the introduction by the Department of the Japanese rice, during the past three years, has been remarkable. At the same time our imports of this product have decreased from 154,000,000 to 73,000,000 pounds. The United States imports yearly nearly $800,000 worth of macaroni. Macaroni wheats have been introduced in the past two years very successfully into the Dakotas and also into Kansas and Nebraska. Fully 90 per cent. of the date palms introduced in recent years from Africa are now growing vigorously in Arizona and southern California. This year a collection of the choicest varieties in Egypt have been obtained. Progress is reported in the introduction of Egyptian cotton. The imports of this product now amount to about $8,000,000 yearly.

Congressional Seed Distribution.—In regard to the Congressional seed distribution, the Secretary states that he has endeavored to meet the wishes of Congress in every way possible and to secure seeds of as high a character as can be obtained under the conditions under which the work is done. It has been arranged to send out cotton seed, tobacco seed, sorghum seed, and sugar-beet seed, and grasses and forage plants, under the direct auspices of the Department, and not through the contractor.

BUREAU OF SOILS.

The Division of Soils has recently been made a Bureau and has received increased financial resources, which enable it to extend its scientific investigations, as well as its practical operations.

Soil Survey.—An extensive review of the work of soil survey shows that the areas surveyed and mapped during the year exceeded 3,500,000 acres, making a total of nearly 6,000,000 acres surveyed during the

past two years. The field work, including preparation of reports, transportation and supplies, has cost an average of $3.26 per square mile, or about 51 cents per hundred acres. A part of the expense has been paid by state organizations, and effective cooperation has been had with the stations. The demands for soil survey in various parts of the country continue to be received in excess of the ability of the Bureau to comply. The Secretary enumerates sundry important results in the work of the survey, but dwells especially upon what has been achieved in connection with tobacco. Especially successful have been the experiments made by the Bureau in the growing of a fine type of Sumatra leaf on certain soils in the Connecticut Valley. During the past year nearly 43 acres have been grown under the direct control of the Department experts. An interesting feature of the experiment is that the bulk of the cost, estimated at $20,000, has been invested by the farmers themselves, and it is gratifying to record that their enterprise has been rewarded far beyond their expectations. The recommendations of the Department have also been followed in the methods of curing tobacco in Pennsylvania, with the result of effecting a saving from the ravages of the black rot, exceeding one-half million dollars. Urgent demands for assistance in the tobacco industry have reached the Department from New York, Wisconsin, Texas and Florida. Referring to the reclamation of alkali lands, to which attention has frequently been called in the reports of the soil survey, the Secretary says that he is more and more convinced that to carry the lesson home to the individual it will be necessary for the Department itself to undertake a practical demonstration of the efficiency of drainage. The necessity of a special study of climatology in connection with the soil work is pointed out. "The time has come," says the Secretary, "when the work should be taken up on a scale commensurate with the extension of at least two or three crop interests. It is certain that the immediate benefit to the farmers will amply repay expenditure."

WORK OF THE BUREAU OF CHEMISTRY.

In this Bureau investigations into the composition, nutritive value and adulteration of food products have been continued. This work during the year was devoted particularly to the study of preserved meats, the composition and nutritive value of the preserved article being compared with the original, and the preservatives, if any were employed, determined. Food products imported into this country, and suspected of adulteration or of containing injurious constituents, have also been examined. The Secretary is authorized to inspect, through the Bureau of Chemistry, American food products intended for export. Unfortunately, Congress has not provided appropriations adequate to the proper execution of this law. The Secretary adds that it is important that our food products going abroad be pure and wholesome, and that we should protect our exporters against discrimination in foreign countries.

In connection with the Bureau of Forestry, the chemist is taking up the work of forest chemistry, and is studying forest trees in their relation to the soil and the products they yield. Among the chemical industries immediately dependent on forest productions are the tanning industry, manufacture of wood pulp, production of wood spirit, charcoal and other products. The sugar laboratory of the Bureau continues to study all the chemical problems relating to the production of sugar-producing plants and the manufacture of sugar. The chief part of this work is devoted to the study of sugar beets. The work that the Bureau of Chemistry is doing for other departments of the Government is considerable and con-

stantly increasing. By agreement with the Secretary of the Treasury, the chief of the Bureau has been designated as supervisor of sugar tests in the laboratories of the appraisers in the ports of New York, Philadelphia and Boston. The other departments to which the aid of the Bureau of Chemistry has been extended are the War Department, the Post-Office Department, the State Department and the Department of the Interior.

In cooperation with the Office of Public Road Inquiries, a laboratory for the study of road materials has been organized in the Bureau of Chemistry. The prime object of this laboratory is to aid road-builders in selecting the best available materials in their localities.

WORK OF THE BUREAU OF FORESTRY.

Another of the newly organized bureaus is that of Forestry. The Secretary reports that this Bureau is cooperating with the Federal Government, with several States and many private owners in handling their forest lands. Altogether, assistance has been asked for a total area of 52,000,000 acres, of which 4,000,000 are held by private owners. The work of forest management is reviewed in some detail. During the year nearly 800,000 acres under private owners were examined by representatives of the Bureau, and four detailed working plans, covering 226,000 acres, were prepared. The working plan for the Black Hills forest reserve was completed and working plans were undertaken for the Prescott and Big Horn and the Priest River reserves.

Forest investigations include the study of commercial trees and economic tree-planting, of forest fires, grazing, lumbering, forest productions, and other important lines. The region containing the proposed Appalachian forest reserve was examined in cooperation with the United States Geological Survey, and nearly 10,000,000 acres were mapped, lands classified and the forests carefully studied. The Secretary regards the creation of the proposed forest reserve as urgent in order to protect the headwaters of important streams, to maintain the already greatly impaired supply of timber and to provide a national recreation ground. Upon the request of the Secretary of the Interior, the effects of grazing and forest fires were investigated on twelve of the forest reserves.

In the study of economic tree-planting in cooperation with farmers and others in making forest plantations, 46,145 acres were examined and plans were prepared for nearly 6,000 acres, while 148,000 applications for tree-planting plans were received.

THE OFFICE OF EXPERIMENT STATIONS.

The Secretary reports, as the result of a broad inquiry made through the Office of Experiment Stations, that by far the largest part of the work of the stations has direct relation to the important agricultural interests of the communities in which they are located.

The work of the stations is becoming better understood by the farmers, and a broader, deeper foundation of scientific inquiry is being laid each year. Cooperation between this Department and the stations continues to increase, and the value of these cooperative methods to the agricultural interests are very generally acknowledged. As a result of the practical confidence so attained, Congress and the State Legislatures have shown a disposition to be liberal with this Department and with the stations. The movement for the separation of the office of director of the station from that of president of the college has advanced, and at present there are but eleven States and Territories in which the college president exercises the functions of director

of the station. At the same time, the amount of teaching required of station officers has been materially reduced.

The experiments of the station in Alaska, with headquarters at Sitka and subsidiary stations at Kenai, on Cook Inlet, and at Rampart, in the Yukon Valley, are regarded as distinctly encouraging. From all the evidence received at the Department, it seems clear that agriculture may be sufficiently established in this Territory to serve as an important aid to the mining, lumbering and fishing industries. During the year a station has been established in Hawaii. Among the first work at this station was the planting of taro, with the special object of studying the diseases seriously affecting that crop. Probably 50 per cent. of the working population in these islands depend on taro for their daily food, and, owing to these diseases and the attendant deterioration of the crop, the price of taro has increased 500 per cent. in the last decade. Some other diseases of fruits and vegetables call for study, and poultry experiments have been inaugurated with a view to increasing the supply of poultry. It is reported that live chickens sell in Honolulu at $15 a dozen and eggs at 40 and 50 cents a dozen. Hogs bring from 10 to 17 cents a pound on the hoof, and experiments have been undertaken in the feeding of swine with various tubers and roots.

The station at Porto Rico has not yet been fully established, owing to the difficulty of securing suitable land for the purpose. In the meantime, such investigations will be undertaken as can be pursued on lands leased or loaned by persons ready to engage in cooperative work with the station director. Some preliminary investigations in coffee culture have already been arranged for.

The Secretary earnestly recommends that the annual appropriations for all these stations be increased to $15,000, the same as the National Government contributes at present to all of the other stations in the various States and Territories.

The Philippines.—He regards it as extremely desirable that agricultural investigations should be undertaken in the Philippine Islands under the War Department and in cooperation with the Department of Agriculture. In furtherance of this work, the Secretary recommends an additional appropriation of $15,000 for the ensuing fiscal year 'to institute agricultural investigations in the Philippines and, if feasible, to locate and maintain an agricultural experiment station there.'

Agricultural Education.—An increase in college-extension work in agriculture is noted and stress is laid on the movement for the establishment of secondary schools of agriculture and the introduction of the elements of agriculture into the rural schools, as hopeful signs of progress in agricultural education. The Secretary suggests that his Department, already giving aid to rural schools in various ways, should take a still more active part in encouraging this work. He recommends encouragement by distributing seeds and plants to establish school gardens, by furnishing schools with collections of specimens of insects, of plant diseases, and other illustrative material, and by supplying the teachers with such publications of the Department as may be useful to them.

Aid to Farmers' Institutes.—He reviews very fully the great development in the work of farmers' institutes. In 1899 over 2,000 farmers' institutes were held in this country, attended by over half a million farmers. These were held in forty-three States and Territories. The Secretary thinks that there is room for much useful work by his Department in aid of this and other movements for the education of our farmers in the improvement of our agriculture. He

has therefore asked for a special appropriation of $5,000 to enable the Office of Experiment Stations to enlarge its work with a view to giving definite aid and encouragement to farmers' institutes in the different States.

Nutrition Studies.—The dietary studies and experiments in cooking, digestion and metabolism, have been conducted in various parts of the United States in cooperation with experiment stations, agricultural colleges and universities. The results of nutrition investigations already made should, the Secretary thinks, be practically and beneficially applied to the feeding of men wherever a considerable number of persons are to be fed on a systematic plan. He instances the hospitals for the insane in the State of New York, the annual cost of food for which is over $1,000,000, and states that of the $26,000,000 expended for 100,000 persons maintained in the public institutions in New York State alone, $6,000,000 is expended for food. He urges investigations to determine the best dietary for the use of our soldiers and civil officers in tropical regions, and states that a special appropriation of $5,000 has been asked for the study of the food supply and consumption of people living in the tropics.

IRRIGATION MATTERS.

The Secretary devotes a great deal of space to a discussion of irrigation investigations. These have been conducted through the Office of Experiment Stations, and embrace (1) studies of irrigation laws and the social and industrial institutions of irrigated agriculture; (2) investigations of the methods by which water is conserved, distributed and used.

Titles to Water.—In reference to the first subject the Secretary states that the character of the titles to water finally recognized will do more than all other influences combined to determine whether the Western farmers ought to be tenants or proprietors. Naturally, this makes the disposal of the water resources of the West a matter of vital importance not only to the persons directly interested, but to the country at large. Every consideration which justified the general government in the control, the survey, and disposal of public lands, applies equally to the orderly and just establishment of titles to water by public authority, either state or national. He points out the confusion and trouble and almost endless litigation frequently attending the settlement of this question, and declares it to be absolutely necessary that some simple and final method of determining and protecting rights to streams should be provided. In the meantime the conditions, as they exist in arid states, are being carefully studied by the Department.

Improved Instruments.—Irrigation experts of the Departments have designed improved instruments for measuring water, by which registers are now furnished to irrigators at about one-half the cost of the foreign instruments.

Irrigation in Humid Regions.—Attention is directed to the growth of irrigation in the humid regions, and the remarkable fact is stated that in Louisiana more money has been expended on pumping-plants in the past two years than in any arid state. By irrigation, rice-growing in Louisiana and Texas has raised the price of land originally worth $5 to $10 per acre to $50 and even $100 per acre.

Legislation by Congress.—The Secretary expresses the belief that irrigation will, in the near future, become a subject for legislation by Congress, there being important reasons why it should have the attention of that body. At the same time, he says that those best informed believe that the uncertain character of water rights can only be remedied by a larger measure of public control and the making of certain classes of

irrigation structures permanently public works. These, it is urged, should not be owned by private parties, and the argument produced in favor of constructing reservoirs by act of Congress is the same which justifies setting aside forest reserves and the maintaining of a force to control them. On the other hand, the Secretary points out that an appropriation of money by Congress to construct such irrigation works will bring the country face to face with a new Government policy and will carry a larger measure of public control over the water resources of the West than has hitherto prevailed or been sanctioned by public sentiment.

Land Laws affecting Irrigation.—He reviews the influence of land laws on irrigation development, stating that laws which control the disposal of 500,000,000 acres of arid public lands must have a vital influence upon the success of irrigated agriculture. He condemns the desert-land act, stating that 640 acres is more land than a man of moderate means can cultivate under irrigation. Cutting down the entries from 640 to 320 acres is an improvement, but he believes in the entire repeal of the desert-land act and in requiring settlers or homesteaders to cultivate as well as live on their land.

The Grazing Lands.—Referring to the grazing lands, he says probably 400,000,000 acres of the public domain has no agricultural value except for pasturage. It is at present an open common, with no laws for its protection or disposal. He refers to the frequent conflicts of the farmers under irrigation with the range stockmen, and recommends, as a remedial and beneficial measure, the leasing of the grazing land in such a way as not to interfere with the homesteader. The rentals, he believes, would amount in the aggregate to a large sum, which could be appropriately applied to the reclamation of the irrigable lands. He points out that such leasing is not an experiment, as it has been successfully tried, although in a limited way, in Colorado, Idaho, Montana, Nebraska, Utah and Wyoming. He winds up the discussion of this subject by presenting the following conclusions:

1. That private enterprise will have to be supplemented by public aid in the construction of certain classes of irrigation works if we are to secure the largest development of Western agriculture.

2. That reservoirs located in the channels of running streams should be public works.

3. That the first step toward national aid for irrigation should be the passage of enlightened codes of water laws by the States to be benefited.

4. That the land laws should be modified by repealing the desert act and by requiring cultivation as well as residence on a homestead.

5. That the non-irrigable grazing lands should be leased in small tracts so as to unite the irrigable and the pasture lands.

WORK IN ENTOMOLOGY.

Under this head the Secretary reports the successful introduction and establishment in California of the fig-fertilizing insect, with the result that it has been thoroughly established at several points, and that the Division of Entomology is now ready to supply fig insects to any grower after he has succeeded in raising to the bearing stage caprifig and Smyrna fig trees. The discovery is reported, by an expert of the Division sent to Asia for the purpose, that the San José scale is not indigenous to Japan, but that it is so in north China. It has been found in a section of that country where there have been no fruit importations, and all fruits are of native sorts. Further, in this district, it was found to have a natural enemy—a ladybird beetle,

of which the expert in question has collected many specimens and forwarded them to Washington, and steps will be taken to acclimatize this important species. This importation will doubtless prove of extreme value to fruit-growers in this country. Another valuable importation of the ladybird beetle was of one which feeds upon several distinct species of plant lice accidentally imported into this country from Europe.

BIOLOGICAL SURVEY.

The Survey is engaged in mapping the natural boundaries of the crop belts of the country. Its aim is to furnish farmers with lists of products likely to be successful, so far as climatic conditions go, in different parts of the country. During the past season the work of mapping the life zones and crop belts has been continued, particularly in Texas and California. A fiber plant, closely related to the Mexican istle or Tampico plant, is found growing in great abundance over a large part of the arid Sonoran zone. In view of the great quantity of fiber of other species of agave imported into this country ($12,000,000 worth in 1900), the Texas species is likely to prove of great value.

In response to constant complaints, the Survey has prepared and distributed a circular of direction for the destruction of prairie-dogs, and is now conducting experiments in the Dakotas, Nebraska, Kansas and Texas, with a view to discovering remedial measures against this pest, cheap enough for general use. It has been discovered that the bullock oriole and the California least tit feed extensively on the orange and olive. In Texas, the large blackbirds, known as jackdaws, and which have been slaughtered in great numbers for the millinery trade, are particularly useful owing to their feeding habits in the rice and cabbage-growing districts. In addition to its other duties, the Survey is charged with the general supervision of matters relating to game protection. In aid of the preservation of native birds and game it has published bulletins on the laws governing the transportation and sale of game, digests of State game laws, etc. Carrying out the provisions of the Lacey act, the Secretary acknowledges his obligations to three other executive departments, the Treasury, Interior and Justice, to several railroad and express companies, and to many State officials and individuals. Under the system of permits established for the transportation of foreign wild animals and birds, 186 permits were issued during the year, covering the entry of 350 animals and nearly 10,000 birds. Numerous violations of the laws regulating interstate commerce and game have been reported to the Department and in many instances it has been called upon to assist in prosecuting the offenders.

THE DIVISION OF STATISTICS.

The work of this Division consists largely in the preparation of reports relative to the principal products of the soil, including the extent and geographical distribution of the area of production, the condition and prospects of the crops during the growing season, and the quantity, quality and disposition of the products harvested. It has included also reports on various branches of rural economics, such as transportation, wages of farm labor, cooperation in agricultural industries, etc. An urgent demand exists for broadening the scope of the work of this Division. But this cannot be done without enlarging its appropriations. Telegraphic interchange of crop reports has been arranged for with the governments of some of the principal grain-growing countries of Europe. In furtherance of the plan to place the crop reports in the hands of the farmers as early as possible, a system of cards containing the most important

points of the statistician's monthly report has been adopted. These cards are mailed promptly after the publication of the telegraphic summary to postmasters throughout the country with the request that they be promptly displayed in their offices. The Secretary recommends the enlargement of the Division under Bureau organization.

PUBLIC ROADS.

In establishing an Office of Public Road Inquiries, the object was to promote the improvement of public roads throughout the country. Efforts were first directed to ascertain the condition of the roads, the state of public opinion in regard to their improvement, the obstacles in the way, and the best methods to be employed in securing better roads—such has been the work of this office up to the present. For spreading information and awakening interest, nothing has been found so effectual as the 'object-lesson,' or sample roads, which, during the past year, have been built in nine States under the advice and supervision of the office. In building these sample roads, machines have been loaned by manufacturers and carried free by the railroad companies, while the local community furnishes material and labor. During the year, for the better carrying out of the work of the office, the United States was divided into four divisions, the eastern, middle, western and southern, each under a special agent.

PUBLICATIONS.

In the performance of its duty to diffuse the information acquired through its several Bureaus, Divisions and Offices, the main dependency is upon the issue and distribution of publications. This work, therefore, affords a fair reflex of the intelligence and activity of the investigating branches of the Department. The Secretary deplores the fact that this condition has not been as fully recognized in the appropriations as it should be, and the work of publication has, therefore, not kept pace with the wonderful growth and development of the Department. He deplores particularly the unavoidable suspension toward the close of the year of the work of both printing and distribution, and that no less than thirty-five worthy employees had to suffer distress by being furloughed through no fault of their own. Notwithstanding these restrictions, there were issued during the year 606 separate publications, aggregating nearly 8,000,000 copies. Nearly 3,500,000 copies were Farmers' Bulletins, of which two thirds in round numbers were distributed under Congressional orders. With the increased appropriation and the accumulated copies, this year's supply of these bulletins will, under the present law, which assigns four-fifths, instead of two-thirds, to the use of Congressmen, make the allowance of each Senator, Representative and Delegate 15,000 copies. A special building has been rented to be devoted exclusively to the storage and shipment of Farmers' Bulletins, of which not less than 7,000,000 will have to be printed this year. The amount provided, however, for material and labor in their distribution is quite inadequate and must be supplemented by a special appropriation, if the demands of Congressmen are to be met. Referring to the great demand for the Year-book and the growth of the Department, the Secretary points out the inadequacy of the quota assigned the Department. When the edition of this work was 300,000 copies, 30,000 were placed at the disposal of the Department, the same as now, notwithstanding that the edition to-day is half a million copies. The demand for the publications of the Department continues to be greatly in excess of its ability to supply. Many of these—over 24,000 copies last year—were sold by the Superintendent of Documents. This is almost three times as many as the

sales made by that officer of the publications of all other Departments of the Government. A special appropriation has been asked for to carry on more effectively the work of illustration, which the condition of the appropriations in recent years has caused to be somewhat neglected. Over 140 persons are employed, including editors, proof-readers, artists, clerks and laborers, in the work of publications, and these are greatly hampered, owing to their segregation in different buildings in crowded and inadequate quarters.

ACCESSIONS TO THE LIBRARY.

Over 4,000 books and pamphlets were added to the Library during the year. These included many books of special value in the work of the Department and a large number of scientific periodicals. Every effort is made in the Library of the Department to meet the demands occasioned by the constantly broadening fields of investigation entered upon by the Department, and to aid educational and scientific workers engaged elsewhere upon kindred work. The Department Library is regarded as the headquarters of agricultural literature, and should be able to meet demands from without as well as within the Department. The Secretary calls attention to the danger of destruction by fire of the 70,000 pamphlets and books now in the Library, owing to the character of the building at present occupied by the Department.

ACCOUNTS AND DISBURSEMENTS.

Congress appropriated $3,303,500 for the United States Department of Agriculture for the fiscal year ended June 30, 1901, being an increase of $558,920 over the appropriation for the preceding year. When all accounts shall have been finally settled the payments will amount to about $3,220,000.

The regular appropriation of $15,000 for each of the 48 agricultural experiment stations in the several States was also made.

On June 30, 1901, the unexpended balance of the appropriations for the year 1899, amounting to $28,899.27, were covered into the Treasury.

During the year $6,340 was paid for rental of leased buildings in Washington. Owing to inadequate accommodations, Congress, at the last session, provided for the lease of additional buildings, and the rental for the fiscal year 1902 will exceed $10,000.

EXPORTATION OF AGRICULTURAL PRODUCTS.

The highest record previously attained in the export of agricultural products—in 1898—was surpassed by over $90,000,000 in the fiscal year of 1901, when a value of over $950,000,000 was reached. Of the merchandise sent abroad during the year, 65 per cent. originated on the farm. Of foreign customers for our agricultural products, the United Kingdom stands first, taking over 50 per cent. The next most important markets are afforded by Germany, France, the Netherlands and Belgium, in the order named. The Section of Foreign Markets has begun the preparation of a most comprehensive report on the character of our agricultural importations received by the United Kingdom, from countries other than the United States. The importance of this report is evidenced by the fact that, large as were our exports to the United Kingdom, they comprised only one-third of the foreign farm produce purchased by that country. Special statistics have been compiled by the Section of Foreign Markets relative to our trade in farm products with our new insular possessions. Our agricultural exports to Cuba, Porto Rico and the Philippines during the year comprised about 53 per cent. of the domestic merchandise sent to these islands. Our imports of agricultural products from these islands exceeded our exports by just $30,000,000.

CONCLUSION.

The report concludes with a review of the development of agriculture and commerce during the past twenty years, and of the contributions by the Department of Agriculture to the progress of events and the building up of domestic and foreign trade. The Secretary says that coincident with this growth numerous institutions have grown up in this country and abroad, devoted to the application of science to the service of agriculture, thus creating a great demand, at good salaries, for the right sort of men. Each nation is seeking to extend its productions, and is depending more and more upon the aid of science. Men combining knowledge with practical experience and ability are hard to get, and hence the Department has to face the necessity of paying much higher salaries, or of being compelled to either lose opportunities of getting the best men or to lose some of those who, under its training, have developed such qualities as make them exceptionally valuable.

He concludes by saying that he would urge upon Congress, in the strongest terms and for the best interest of the country, such liberality as will enable him to obtain and retain the best men that can be found to fill the important places at his disposal.

MEMBERSHIP OF THE AMERICAN ASSOCIATION.

THE following have completed their membership in the American Association for the Advancement of Science during the month of November:

Samuel L. Bigelow, Ph.D., Asst. Prof. Chemistry, University of Michigan, Ann Harbor, Mich.

Thos. A. Chittenden, Instr. in Mechanical Engineering, A. & M. College, W. Raleigh, N. C.

Patrick B. Delany, Electrician, Inventor, South Orange, N. J.

Wm. Fox, Asst. Prof. Physics, The College of the City of New York, New York, N. Y.

Manuel R. Gutierrez, Prof. Physics, Normal School, Calle de las Victimas, No. 1, Jalapa, Vera Cruz, Mex.

John J. Hollister, Mining Engineer, Gaviota, Santa Barbara Co., Cal.

John W. Leonard, Author-Lawyer, Wheaton, Ill.

Wm. L. Martin, Augusta, Ga.

George H. Maxwell, Chairman, Natl. Irrigation Ass'n, 1827 Phelps Place, Washington, D. C.

Charles P. Nott, Palo Alto, Cal.

C. Howard Parmly, Asst. Prof. Physics, The College of the City of New York, New York, N. Y.

Wm. B. Potter, Ch. Eng. Ry. Dept. G. E. C., Gen. Elec. Co., Schenectady, N. Y.

Ferdinand A. Schiertz, Rosario Mines Ltd., Guadalupe y Calvo, Chihuahua, Mexico.

Solon Shedd, Prof. Geology and Mining, State Agric. College, Pullman, Wash.

Dr. Edw. G. Spaulding, Instr. Philosophy, The College of the City of New York, New York, N. Y.

Dr. Edw. W. Taylor, Instr. Neuropathology, Harvard Medical School, Boston, Mass.

Jos. B. Tyrrell, Mining Engineer, 181 Metcalfe St., Ottawa, Canada.

SCIENTIFIC BOOKS.

Practical X-Ray Work. By FRANK T. EDDYMAN, B.Sc. (Lond.), F. I. C. London, Scott, Greenwood & Co.; New York, D. Van Nostrand Company. Price, $4.00.

This little book, as the name indicates, seems to be a thoroughly practical guide for the beginner in X-ray work. As would be expected, the scientific knowledge to be gained by even a careful study of the treatise must be almost entirely empirical. The scope and purpose of such a book quite preclude treating the physics of the subject in any but a statement-of-fact way.

The work is divided logically into three parts; the first part, wisely brief, treats of the history of the development of X-ray practice; the second, of the apparatus and of its management; the third, of practical X-ray work.

It is to be noted that Mr. Eddyman is a physicist and presumably trained in the science of the subject; also that he has charge of the radiographic work in a large hospital, and so has had ample experience in the practical application of X-ray diagnosis in surgical and medical cases. Such a combination is almost necessary if one is to prepare a book of real value on this subject. The author seems to have succeeded admirably, giving only enough of the pure physics to make the application of it intelligible, and

going into the detail of manipulation with great care and thoroughness.

In Chapter II., dealing with sources of electricity, somewhat more space than is necessary seems to be given to primary batteries, since in this country at least such sources of current are seldom if ever found desirable. The use of the alternating-current supply is discouraged rather briefly (p. 42) when we consider that a motor-generator is known to be a very convenient and efficient method of deriving a low-voltage direct current from a higher-voltage alternating source.

A very important point in the design of contact breaks is emphatically presented (p. 66) and exceedingly well explained. It is very desirable that the duration of 'make' be long as compared with the time of 'break'; thus an interval is allowed long enough for the current to reach a maximum value before it is interrupted. Makers quite often pay too little attention to this, and writers frequently ignore it altogether.

The classification of breaks (p. 66) should, in the writer's opinion, include a fifth, viz., mechanical breaks. Such breaks have been used in this country with much success.

In the description of various tubes (Chap. 5), it is a cause of surprise and regret that one or two very effective American tubes are not mentioned. The automatic regulating tube invented by Sayen is used all over the United States and has been highly spoken of abroad by no less authorities than Lord Kelvin and Röntgen himself. The scope and plan of the book in general is such as to commend it to the writer as the best of the few that have yet appeared on the subject.

It should be a very valuable aid to all engaged in X-ray work who have not had much experience of their own, though, as the author clearly states, such personal experience is absolutely necessary to all who would produce reliable results.

Very little seems to be said in Mr. Eddyman's book about the use of X-ray methods in medical diagnosis, though that line has been considerably developed in this country. The results of investigators in all countries except in England seem to have been rather consistently overlooked.

ARTHUR W. GOODSPEED.

Lehrbuch der Meteorologie. Von DR. JULIUS HANN. Leipzig, Tauchnitz. 1901. Royal 8vo. Pp. xiv + 805. Pls. 8. Charts 15. Figs. 111.

That a text-book of meteorology from the hand of the leading meteorologist of the world would be a masterly presentation of the subject was a foregone conclusion. No one is better qualified than Dr. Hann to write such a book. As director of the Hohe Warte in Vienna; professor in the Universities of Vienna and of Graz; editor of the *Meteorologische Zeitschrift;* a life-long original investigator of the widest range of meteorological phenomena; an earnest student of meteorological publications in all languages, Dr. Hann has brought to his latest work a wonderfully rich experience and an amazing fund of knowledge.

The 'Lehrbuch der Meteorologie' is more than a text-book. It is rather a treatise on meteorology. It ranks as a worthy companion to the same author's 'Handbuch der Klimatologie.' The 'Lehrbuch' is not intended to be a 'popular' presentation for beginners, nor is it adapted for general reading. It is a systematic and concise review of the whole subject of meteorology, as complete as is possible within the limits of 800 pages. Nothing of any importance is omitted. Admirable brief historical summaries of the different topics are followed by references to the results of the most recent investigations. So many, so well selected, and so complete are the references, in text and footnotes, that the book is indispensable to every student of meteorology simply as a bibliography. In fact, teacher and student alike will want to have this volume always close at hand, on their desk, or on the nearest shelf of their bookcase.

Since Schmid published his classical 'Lehrbuch der Meteorologie,' in 1860, no author has attempted so complete a presentation of the subject as has been given by Dr. Hann. In its general plan the new 'Lehrbuch' is not unlike that of Schmid, allowing for the natural changes which have resulted from the advance of the science during the last forty years. Schmid's 'Lehrbuch' was a landmark in its time, and is so still, as a classic. Hann's 'Lehrbuch' now occupies, and will continue to occupy, a similar position. Schmid's book was overweighted

with tabular matter and with mathematical discussions. Dr. Hann has very wisely reduced his tabular matter to a minimum, and has devoted an appendix to the consideration of the more important physical theories which involve mathematical treatment. A few of the shorter and simpler formulæ only are included in the general text. By this arrangement the text is unencumbered, and the reading becomes easier and pleasanter. None of the modern text-books of meteorology, of which there are many, attempt to cover the field which Dr. Hann has so successfully covered. Hence no comparison of the new 'Lehrbuch' with these text-books is desirable, or even possible.

There is clearly no need to outline the contents of such a book as that now before us. Throughout, in the arrangement of the contents, the treatment of each subject, and the selection of the references, the hand of the master is clearly seen. If we were to single out one chapter which is likely to be of the most general interest to meteorologists at the present time, it would probably be that dealing with the theory of extra-tropical cyclones, a subject in the discussion of which Dr. Hann has taken a very prominent part, he being a strong advocate of the dynamic theory of the origin of these disturbances. In this country, Mr. H. H. Clayton, of Blue Hill Observatory, and Professor F. H. Bigelow, of the Weather Bureau, have made interesting contributions to this discussion. An excellent summary of the main facts in the case is given, and the position of the author is made clear by the statement (p. 586): "Es soll also hier die Ansicht vertreten werden, dass es zwar atmosphärische Störungen und damit Wirbelbildungen mannigfachen Ursprunges giebt, dass aber die Hauptursache derselben, namentlich aller grösseren und langlebigeren atmosphärischen Wirbel, in den Störungen der grossen atmosphärischen Zirkulation zu suchen sein dürfte."

Americans may well take satisfaction in noting the frequent references made by Dr. Hann to the work of Mr. H. H. Clayton and of his associates at Blue Hill Observatory, and also to that of the Weather Bureau. For a book of the size of this 'Lehrbuch' there are comparatively few illustrations in the way of charts and weather maps. Since the publication of Bartholomew and Herbertson's new 'Atlas of Meteorology,' however, there is not much need of introducing charts into text-books of meteorology, especially when the books are of such a grade as the present one. There are four half-tone views of clouds; one of lightning; two of hail-stones, and one of a waterspout. This waterspout is the one which occurred off the southern coast of New England on August 19, 1896 (see SCIENCE, N. S., Vol. IV., 1896, p. 718). Isothermal, isanomalous, isobaric, wind and rainfall charts are included.

It is seldom that a reviewer has so pleasing a task as that involved in writing a notice of Hann's 'Lehrbuch der Meteorologie.' The book is a masterpiece. R. DEC. WARD.

A Manual of Determinative Bacteriology. By F. D. CHESTER, Delaware College Agricultural Experiment Station. N. Y., The Macmillan Co. Price, $2.60.

Systematic bacteriology is the *bête noir* of the bacteriologist. The amount of confusion which exists in literature regarding the description of species is hardly conceivable. The descriptions are found scattered through an extensive literature; they are sometimes verbose and extended, and at other times brief and insufficient. Anything which looks toward a simplification of this complex problem will always be received with relief by bacteriologists.

The work of Professor Chester is a somewhat modest attempt to give a little assistance in this realm of confusion. It does not pretend to be a study of systematic bacteriology, but rather, as the name indicates, of *determinative* bacteriology. The author has endeavored to collect all species of bacteria which have been sufficiently described for even moderately satisfactory determination, and to arrange these within the limits of one medium-sized book in such a way that they can easily be found. By the use of artificial analytical keys, based upon simple, but important characters, the bacteria which the author includes in his list have been classified into easily distinguishable groups.

The amount of labor which has been involved in the collection and tabulation of these numerous species, about 800 in all, is very great.

Inevitably, also, the work is very uneven. Professor Chester has been obliged to use as his data the descriptions published by the numerous bacteriologists, and inasmuch as these descriptions vary so widely in their accuracy and in the extent of the details given, there is considerable difference in the completeness of the descriptions of species listed. But this, of course, cannot be laid to the fault of the author, but rather to the incompleteness and irregularity of the original descriptions.

Two phases of this work are of especial value, and bacteriologists will owe a debt to Professor Chester for introducing them. The first is the substitution of a new, descriptive word for the long, frequently verbose descriptions which have been widely used by bacteriologists. The single word 'arborescent' is quite as descriptive as the long phrase commonly found in bacteriological descriptions. A careful study of the essential characters of colonies, gelatin growths, etc., has enabled Professor Chester to select a comparatively small number of words which are distinctively characteristic, and which can almost always be used in place of the long paraphrases. This makes it possible to reduce the length of descriptions and to give them in the form of terse sentences, with a few characteristic adjectives. The work of describing species is thus immensely simplified. The second important addition is the arrangement of analytical keys. This, in itself, is one of the most important phases of the work. By the use of these analytical keys it is quite easy to trace any unknown species of bacterium very quickly to its proper place in Professor Chester's list, and then, by further study of a few carefully drawn descriptions, to determine whether the unknown species corresponds with any of those previously described. It is hardly necessary to emphasize the immense value it will be to bacteriologists to have all the known species of bacteria systematically arranged and traceable by means of a skilfully devised key. In these two respects the work of Professor Chester will be of the utmost assistance to bacteriologists.

The author adopts Migula's classification, based upon flagella, and this inevitably makes a part of the arrangement of species uncertain. A large majority of the descriptions of bacteria in literature contain no reference to flagella. In many cases, therefore, Professor Chester has been forced to infer the presence or absence of flagella, and to classify the organisms to a certain extent in this way by guesswork. Without attempting to criticise the value of a classification based upon flagella, one cannot but deplore the fact that the classification must be based upon characters so difficult to determine. Most bacteriologists are more interested in the physiological aspects of bacterial action than in their structure, and it will be a long time before the students of bacteria will become so familiar with microscopic methods as to be able to describe the distribution of flagella. For species described in past years, and for those described by many bacteriologists for years to come, we must expect that the distribution of flagella will be a subject not attended to with sufficient accuracy to make possible a grouping of the species according to Migula's classification. At all events, in this determinative list of Chester's many of the species are classified without any knowledge of their flagella, and their arrangement into groups, as Professor Chester has arranged them, is, in many cases, therefore, a pure matter of inference.

One other point may raise more criticism. The author has taken the liberty to give names to unnamed species. Where an author refers to a bacterium by number, Chester has given it a name. The original author will, therefore, frequently quite fail to recognize an old friend under a new name. The use of synonyms and a good index of names, however, relieve some of the difficulties arising from this wholesale use of new names.

It is, of course, inevitable that in a work of this sort there will be some omissions. Each bacteriologist who is particularly well acquainted with a certain group of bacteria will, naturally, be able to look through the treatment of Professor Chester and find many points to criticise. Each specialist will, doubtless, find some omission and be inclined to differ with the author in regard to the proper relationship of the species. This, however, is inevitable and does not at all detract from the usefulness

of the work. The work is at best a provisional one, and one which will require constant modification and perfection in future years. On the whole, the work is of a high character and must hereafter form a part of the library of every bacteriological laboratory.

H. W. CONN.

Das Wirbelthierblut in Mikrokristallographischer Hinsicht. Von DR. H. U. KOBERT, mit einem Vorworte von PROFESSOR DR. R. KOBERT. Stuttgart, Ferdinand Enke. 1901. Pp. 118, mit 26 in den Text gedruckten Abbildungen.

The reviewer does not recall any monograph since Preyer's 'Die Blutkrystalle' (1871) which presents the literature on the crystalline derivatives of the blood in the manner of this little book. In view of the medico-legal importance of the microchemical methods for the detection of blood, Dr. Kobert has given in detail numerous directions for obtaining various blood-pigment derivatives in crystalline form; many of these have originally been suggested by the well-known pharmacologist and physiological chemist, Professor R. Kobert of Rostock, to whom the author—his nephew—is largely indebted. While the monograph is intended for physicians and chemists rather than for the crystallographer, purely chemical methods of examination are only considered incidentally. Each chapter concludes with an historical summary of the literature on its subject. Among the topics treated are hemocyanin, in connection with which the reader may now consider the very recent paper by Henze (*Zeitschr. f. Physiol. Chem.*, XXXIII., 370), arterin and phlebin, to prove the independent existence of which (in distinction from oxyhæmoglobin and hæmoglobin) the author devotes considerable space; methæmoglobin and similar compounds; hæmatin and hæmin, with many (in part unpublished) data regarding the so-called Teichmann's crystals; hæmochromogen, of the crystals of which several photomicrographs are reproduced and form a useful addition to the usual text-book description; hæmatoporphyrin, melanins, serum-proteid crystals, hæmosterin and a few other crystalline derivatives.

Dr. Kobert's monograph may properly be studied in connection with Schulz's 'Die Krystallisation von Eiweissstoffen' (reviewed in SCIENCE of November 1, 1901), which likewise deals with the blood proteids.

LAFAYETTE B. MENDEL.

SHEFFIELD SCIENTIFIC SCHOOL
OF YALE UNIVERSITY.

SCIENTIFIC JOURNALS AND ARTICLES.

The Popular Science Monthly for December has for its first article 'A Mechanical Solution of a Literary Problem' by T. C. Mendenhall, this being the noting of the relative frequency with which words of a given number of letters occur in the writings of various authors as compared with Shakespeare. The results were plotted in curves, and the curve derived from the plays of Marlowe was almost identical with that derived from the plays of Shakespeare. Sir Robert Giffen discusses 'The Importance of General Statistical Ideas,' showing the application of Statistics to the solution of such questions as the probable increase of population, food supply, commerce or manufactures. R. T. Glazebrook describes 'The Aims of the National Physical Laboratory of Great Britain' and under the title 'Cement for a Modern Street' S. F. Peckham treats of the progress that has been made in the manufacture of good cements. In 'The Influence of Rainfall on Commerce and Politics' H. Helm Clayton shows that there is a certain periodicity in years of abundant rainfall and consequent plentiful food supply and general prosperity. The political party which chances to be in power during these seasons of plenty assumes the credit for them which is really due to weather conditions. William L. Poteat tells of 'Lucretius and the Evolution Idea' and D. T. MacDougal briefly describes 'The Sensory Mechanism of Plants.' Finally, under the caption 'The Reception of the Origin of Species,' we have a reprint of some of the more noted reviews which appeared shortly after the publication of that work.

Bird Lore for November–December completes the third volume of this magazine, and contains the index for the past year. The number comprises 'Recognition Marks of Birds,' by Ernest Seton-Thompson; 'A Bird of the Season,' by

C. William Beebe; 'Mocking-bird Notes,' by Lucy Gould Baldwin; 'A New Device for Securing Bird's Pictures,' by Frank M. Chapman; 'Bird Life in the Klondike,' by Tappan Adney, and a poem 'On Hearing a Winter Wren Sing in Winter,' by Lynn Ten Sprague. 'Birds and Seasons' now gives place to 'How to Name the Birds,' studies of the families of Passeres, by Frank M. Chapman, the first of a series of papers on identification. In the Department for Young Observers, E. W. Sinnott tells of 'My Bird Restaurant,' while many notes and reviews and an account of the New York meeting of the American Ornithologists' Union complete a large and well-illustrated number. The frontispiece of a ptarmigan on its nest deserves particular mention as a fine example of protective coloration.

The Museums Journal of Great Britain contains a brief but suggestive article by F. W. Rudder 'On the Registration of Type Specimens by Local Scientific Societies,' showing the desirability of having published records of types in the possession of societies or individuals. E. M. Holmes contributes a paper 'On the Arranging and Indexing of Scientific Pamphlets in Museum Libraries,' a subject which has been pretty well worked out in the United States. D. P. H. discusses 'Hygiene as a Subject for Museum Illustration' and there are a large number of notes from many museums in various parts of the world.

SOCIETIES AND ACADEMIES.

CALENDAR.

The American Association for the Advancement of Science. A meeting of the council will be held at the Quadrangle Club, University of Chicago, on the afternoon of January 1. Section H (Anthropology) will meet in the Field Columbian Museum, Chicago (December 31 and January 1 and 2). The next regular meeting of the Association will be held at Pittsburg, Pa. (June 28 to July 3). A winter meeting is planned to be held at Washington during the convocation week of 1902-3.

The American Society of Naturalists will hold its annual meeting at the University of Chicago (December 31 and January 1). In conjunction with it will meet the Naturalists of the Central States and several affiliated societies, including the American Morphological Society (beginning on January 1); The American Physiological Society (December 30 and 31); The American Psychological Association and the Western Philosophical Association (December 31 and January 1 and 2); The Society of American Bacteriologists (December 31 and January 1), and The American Association of Anatomists (December 31 and January 1 and 2).

The Astronomical and Astrophysical Society of America will meet in Washington (beginning on December 30).

The Geological Society of America will meet at Rochester, N. Y. (December 31 and January 1 and 2).

The American Chemical Society will meet at the University of Pennsylvania, Philadelphia (December 30 and 31).

The Society for Plant Morphology and Physiology will hold its fifth annual meeting at Columbia University, New York City (December 31 and January 1 and 2).

WINTER MEETING OF SECTION H, ANTHROPOLOGY, OF THE AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE.

THE Secretary has received the following titles of papers for presentation at the meeting to be held in Chicago, December 31, 1901, and January 1–2, 1902:

'The Beginnings of Anthropology': W J McGEE.

'Twenty Years of Section H': GEORGE GRANT MACCURDY.

'The Exhibit of Hopi Ceremonies in the Field Columbian Museum': GEORGE A. DORSEY.

'On Some Painted Stone Slabs from the Graves of the Ruins of Walpi': C. L. OWEN.

'Basketry Designs in Northern California': ROLAND B. DIXON.

'Pueblo Indian Settlements near El Paso, Texas': J. WALTER FEWKES.

'Field Work in Arizona, 1901': WALTER HOUGH.

'The Anthropological Work of the Hyde Expedition': ALES HRDLICKA.

'Some Observations concerning the Navaho Blanket Industry': FRANK RUSSELL.

'Certain Forms of Winged-Perforated Slate Objects': WARREN K. MOOREHEAD.

'The Variability of Anthropometric Types': FRANZ BOAS.

'A Voice Tonometer': C. E. SEASHORE.

'The Psychological Elements of Visual Space Orientation About a Horizontal Axis': ROBERT MACDOUGALL.

'The Sherman Anthropological Collection, Holyoke, Mass.': GEORGE GRANT MACCURDY.

'The Significance of the Cross': PAUL CARUS.

SECTION OF ANTHROPOLOGY AND PSYCHOLOGY OF THE NEW YORK ACADEMY OF SCIENCES.

A MEETING was held on November 25, with Professor Farrand occupying the chair.

Professor Robert MacDougall stated some of the conclusions of an investigation into the 'Combination of Simple Rhythm Groups in Higher Syntheses, and their Equivalences.' He has found that the simplest rhythmic units are always combined into larger groups, provided only the units succeed each other with sufficient rapidity. And these larger groups may be combined into others still larger—a process to which no definite limits can be set. The simplest group of rhythmic units is the pair or dipody, which appears in every rhythmic series that admits of such grouping. The means by which this coupling of the units is accomplished in poetry are: Subordination of the accent of one unit to the accent of the other, differentiation in the intervals, introduction of mid-line and final pauses, catalexis and rhyme. In any sort of rhythm that is objectively expressed, the first unit of a dipody receives the major accent, and also occupies more time than the second unit. Even in a long rhythmic series, there is properly no mere reduplication of units, but each unit fulfils a unique function in the series, in virtue of which it is differentiated from all the other units, in emphasis and duration and also in its internal configuration.

Professor Edward L. Thorndike spoke of some general aspects of the investigation which he is at present carrying on into the correlations amongst mental abilities. He found that regular correlation, where each degree of one function involves a similar degree of the other, is by no means the rule in the case of mental abilities. The relationships are often extremely irregular. For instance a high degree of one ability may go with a high degree of another but all other grades may involve no similarity in the other. A single coefficient of correlation in such cases is of course an absurdity. Correlations seem more marked between complex than between simple abilities. A variation of the Pearson method was outlined, which is well adapted to work with mental correlations and especially with studies involving few cases.

As samples of his results, Dr. Thorndike demonstrated the absence of correlation between certain motor and mental tests, the pronounced correlation between ability to spell and ability to notice the structure of words, the pronounced correlations between school marks in different subjects and the lesser degrees of correlation in the case of objective tests in the same subjects.

Mr. J. Franklin Messenger outlined an 'Experimental Study of Number Perception.' His experiments had reference to the so-called space threshold in tactile sensations, to the fusion of touch sensations, and to the perception of number through touch. The validity of a threshold determined only by the distance apart of the two points applied to the skin was denied, because distance is only one of the elements on which the perception is based, and often not the most important element. The fusion of two tactile sensations was also denied because of such facts as the following, that two points, *one on each hand*, may be perceived as one point when the hands are close together.

The speaker offered a theory of the tactile perception of number. Number is not directly sensed by touch, but is inferred from various peculiarities of the tactile sensation, such as the geometrical arrangement of the stimulating objects, the distance apart of these objects, the contour of the surface stimulated—and also from the preceding sensation and the attitude of the subject.

R. S. WOODWORTH,
Secretary.

TORREY BOTANICAL CLUB.

AT a meeting of the Club at the College of Pharmacy on October 30, the scientific program was opened by a paper by Dr. D. T. MacDougal, entitled, 'Some Characters of Alpine Vegetation.' The paper was illustrated with numerous sheets of mountain plants from Montana, many of them with attached photographs showing the habitat. In the Missoula region where Dr. MacDougal was working this summer, the growing season for many plants was about 40 days only, but the actual light reaching the plants may have been 30 to 40 per cent. greater than at sea level, and with a larger

proportion of blue rays. These mountain tops may be among the dryest places on the continent or may contain swamp pockets. There is no distinct type of Alpine vegetation as such; but Alpine plants are really xerophytes, being such plants as have adapted themselves to an insufficient water supply.

Our Alpine plants are often thought to be identical with polar plants. But the polar plant receives light continuously through a long period, though the light is of little intensity. The polar plant has an atmosphere of much greater humidity, but a much colder soil. Polar plants develop much greater thickness of leaf. Alpine plants abound in more numerous protective devices, as waxy coatings, hair, thicker stems, and modes of propagation without seeds. *Poa alpina*, for example, in many mountain regions is never known to flower.

Remarks followed regarding the viviparous state of *Poa alpina*, Dr. Rydberg observing its abundance in Greenland and Spitzbergen, and Miss Isaacs remarking on her collecting it at 7,500 feet altitude during the last summer in Switzerland.

Dr. Underwood called attention to the relative amount of sunlight in tropical and in northern regions, showing that the amount of light is much greater north of the tropics, though more oblique.

Discussion followed regarding relations of moisture. Dr. Schoeney referred to the peculiar erect and densely appressed stems assumed by a cespitose *Opuntia* about Boulder, Colorado. Dr. MacDougal spoke of the remarkable degree to which many of the *Cacti* have adapted themselves to xerophytic conditions, so that they lose water less than $\frac{1}{300}$ as readily as in ordinary plant structures in similar positions.

Dr. Rydberg referred to the permanent moisture found within ten or twelve inches of the surface in the dry sand hills of Nebraska.

The second paper was by Dr. P. A. Rydberg, 'Revisions of *Limnorchis*,' being a study now printing in the *Bulletin*, treating of the former genus *Habenaria* and of segregations accepted from it, including the new genera *Limnorchis*, the green and swamp orchids of the Eastern United States, *Piperia*, *Lysiella* and *Gymnadeniopsis;* and the revival of the genus *Blephariglottis* of Rahnesque. The first *Limnorchis* described was Koenig's '*Orchis hyperborea*,' often found in Iceland and Greenland, but rare in America, though sometimes occurring in the cold upper region of New York and Canada. Discussion of synonymy and illustration by numerous specimens accompanied the paper. The diagnostic characters were drawn from the spur, lip and stamens, 24 species of *Limnorchis* and 9 of *Piperia* being recognized.

Reference was made by Mr. G. H. Watson to a remarkable growth near Ellenville, New York, where two trees not only different in species, but in family had so twisted together as to become incorporated, and in response to remarks appreciating its significance, he promised further investigation and a photograph of the trees.

Edward S. Burgess,
Secretary.

SCIENCE CLUB, UNIVERSITY OF WISCONSIN.

At the November meeting of the University of Wisconsin Science Club, Professor C. S. Schlicter presented a paper on 'A New Method of Determining the Size and Velocity of Underground Streams,' and A. H. Pfund discussed 'The Dispersion and Absorption of Selenium.'

During the past summer Professor Schlicter made preliminary tests, for the Hydrographic Division of the U. S. Geological Survey, of the movement of streams percolating through sands and gravels beneath rivers like the Arkansas and Platte, which, across the semi-arid plains in western Kansas and Nebraska, entirely disappear during the months of July and August. The method devised for these tests was an electrical one which permitted rapid and extensive surveys to be made at low expense. A double row of one and one-half inch drive wells was sunk across the channel of the river. The upstream wells were charged with a strong electrolyte, which dissolved and passed downstream with the underground water. When the chemical reached the lower wells its presence was shown by the deflection of a needle, and the rate of movement was then easily calculated. The underground flowage at the places tested was found to range from 3 to 15 feet per day, and to be fairly constant, not

varying more than 10 per cent. The gradient at such places is 8 to 10 feet per mile.

Professor Schlicter's paper was discussed by Professors C. R. Van Hise, J. B. Johnson, F. W. King, F. E. Turneaure and E. A. Birge.

Mr. Pfund discussed the 'Dispersion and Absorption of Selenium.' By devising a new method for depositing films of the aniline dyes on glass and for photographing the interference fringes produced by a Michelson interferometer, the dispersion of amorphous selenium, a comparatively opaque substance, has been successfully studied. The refractive index of selenium rises with extraordinary rapidity until at the limit of the photographic field it reaches a value of 3.13, one of the very highest known. In general, the light-absorbing power of selenium lies between that of the aniline dyes and that of the metals. With a small concave grating, it has been found that selenium absorbs light more and more strongly as the end of the ultra-violet spectrum is approached, instead of there being a region of retransmission.

C. K. LEITH.

DISCUSSION AND CORRESPONDENCE.

THE MATHEMATICAL THEORY OF THE TOP, SIMPLIFIED.

TO THE EDITOR OF SCIENCE: Professor A. G. Greenhill has been good enough to show me his terse method of treating the top integrals. As this is a subject on which Professor Greenhill speaks authoritatively, and will interest a number of your readers, in particular his many friends in Sections A and B of the American Association, I suggest that it be published in SCIENCE.

CARL BARUS.

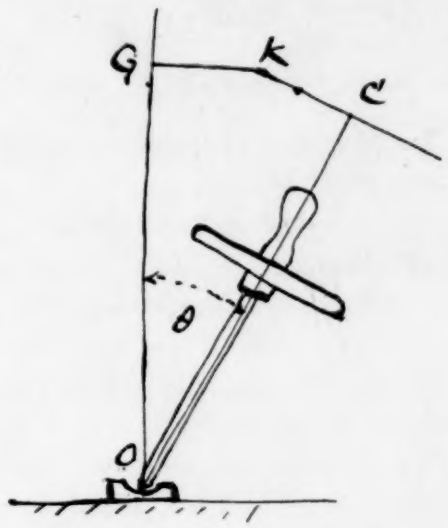
Brown University, Providence R. I.,
November 20, 1901.

Let the vector OH represent the resultant angular momentum of a symmetrical top; spining about its point O is a small smooth fixed cup, as in the Maxwell top.

Since the axis Og of the torque of gravity is always horizontal H will describe a curve (a Poinsot herpolhode), in a fixed horizontal plane at a height OG above O, the vertical vector OG representing the constant component G of angular momentum about the vertical.

We assume that the component G' of the angular momentum of the top about its axis OC remains constant, as there is nothing to alter it, if the top is symmetrical.

FIG. 1.



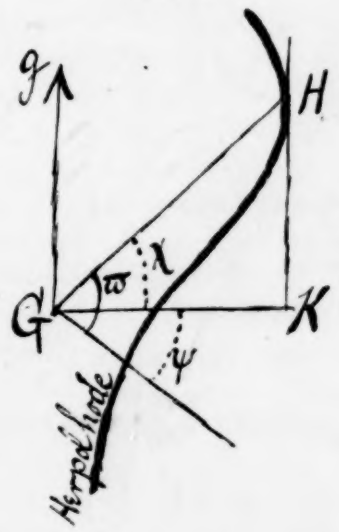
Expressed by Euler's angles θ and ψ the vector OH has the components (Figs. 1 and 2)

$$(1) \quad OC = G', \; CK = A_1 \sin\vartheta \frac{dx}{dt}, \; KH = A_1 \frac{d\vartheta}{dt},$$

A_1 denoting the moment of inertia of the top about an axis through O perpendicular to OC.

The velocity of H is equal to the torque of gravity $Wgh \sin\vartheta$, so that, denoting the polar

FIG. 2.



coordinates of H in the horizontal plane GHK by ρ and π, and resolving in the radial direction GH.

$$(2) \quad \frac{d\rho}{dt} = Wgh \sin\vartheta \cos GHK = Wgh \sin\vartheta \frac{KH}{\rho}$$

$$(3) \qquad \rho \frac{d\rho}{dt} = A_1 Wgh \sin\vartheta \frac{d\vartheta}{dt},$$

and integrating,

$$(4) \qquad \tfrac{1}{2}\rho^2 = A_1 Wgh\,(E - \cos\vartheta).$$

To make the equations homogeneous, put

$$(5) \qquad OG = \delta,\ OC = \delta',\ 4A_1 Wgh = k^2,$$

so that

$$(6) \qquad \rho^2 = \tfrac{1}{2}k^2(E - \cos\vartheta).$$

Now denoting the perpendicular GK from G on the tangent at H by p,

$$(7) \qquad p\sin\vartheta = \delta' - \delta\cos\vartheta,$$

so that, eliminating ϑ,

$$(8) \qquad p^2 = \frac{[\delta' k^2 - \delta(Ek^2 - 2\rho^2)]^2}{k^4 - (Ek^2 - 2\rho^2)^2},$$

and this is the characteristic geometrical property of a Poinsot herpolhode; it also defines the trace of a rolling line of curvature, the intersection of an ellipsoid and a confocal hyperboloid of two sheets, and then δ is the angle between the generating lines of the confocal hyperboloid * of one sheet through H (Darboux).

Since

$$(9) \qquad KH^2 = GH^2 - GK^2,$$

$$(10) \qquad A_1^2\left(\frac{d\vartheta}{dt}\right)^2 = 2A_1 Wgh(E - \cos\vartheta) - \frac{(G' - G\cos\vartheta)^2}{\sin^2\vartheta};$$

and putting $\cos\vartheta = z$, $\dfrac{Wgh}{A_1} = n^2$,

$$(11) \qquad \left(\frac{dz}{dt}\right)^2 = 2n^2 Z,$$

$$(12) \qquad Z = (E - z)(1 - z^2) - \frac{(G' - Gz)^2}{2A_1 Wgh}$$

$$= (E - z)(1 - z^2) - 2\left(\frac{\delta' - \delta z}{k}\right)^2.$$

Denoting the roots of $Z = 0$ by z_1, z_2, z_3, and arranging them so that

$$(13) \qquad z_1 > 1 > z_2 > z > z_3 > -1,$$

then with $\dfrac{d\vartheta}{dt}$ positive, $\dfrac{dz}{dt}$ negative, as in Fig. 1,

$$(14) \qquad nt = \int_z^{z_2} \frac{dz}{\sqrt{2Z}},$$

an elliptic integral of the first kind; and, by inversion, z is an elliptic function of t.

To make the reduction to Legendre's standard form, put

$$(15) \qquad z = z_2\sin^2\phi + z_3\cos^2\phi,$$

$$(16) \qquad z - z_3 = (z_2 - z_3)\sin^2\phi,$$

$$(17) \qquad z_2 - z = (z_2 - z_3)\cos^2\phi,$$

$$(18) \qquad z_1 - z = (z_1 - z_3)\Delta^2\phi,$$

$$(19) \qquad k^2 = \frac{z_2 - z_3}{z_1 - z_3},\ k'^2 = \frac{z_1 - z_2}{z_1 - z_3};$$

then

$$(20) \qquad nt = \sqrt{\left(\frac{2}{z_1 - z_3}\right)}\int_\phi^{\frac{1}{2}\pi}\frac{d\phi}{\Delta\phi} = \sqrt{\left(\frac{2}{z_1 - z_3}\right)}\,(K - F\phi),$$

$$(21) \qquad F\phi = K - mt,\ mt = \sqrt{\left(\frac{z_1 - z_3}{2}\right)}\,nt.$$

Then, in Jacobi's notation,

$$(22) \qquad \phi = am(K - mt),$$

and in Gudermann's notation,

$$(23) \qquad z = z_2 Sn^2(K - mt) + z_3 Cn^2(K - mt),$$

the expression of z or $\cos\vartheta$ by elliptic functions of t.

Next, denoting the angle KGH by χ,

$$(24) \qquad \tan\chi = \frac{KH}{GK} = \frac{A_1\sin\vartheta\dfrac{d\vartheta}{dt}}{GK\sin\vartheta} = \frac{\sqrt{(2A_1 WghZ)}}{G' - G_2} = \frac{\sqrt{2Z}}{2\dfrac{\delta' - \delta_2}{k}},$$

$$(25) \qquad \sin\vartheta\cos\chi = \frac{G' - G_2}{\sqrt{[2A_1 Wgh(E - z)]}},$$

$$\sin\vartheta\sin\chi = \frac{\sqrt{Z}}{\sqrt{(E - z)}}.$$

Resolving transversely to GH, or rather, taking the moment of the velocity of H round G,

$$(26) \qquad \rho^2\frac{d\pi}{dt} = Og \cdot GK = Wgh\sin\vartheta \cdot GK = Wgh\,(G' - G\cos\vartheta)$$

so that, from (6),

$$(27) \qquad \frac{d\pi}{dt} = \frac{G' - G^2}{2A_1(E - z)}$$

$$(28) \qquad \pi = \frac{Gt}{2A_1} + \frac{G' - GE}{2A_1}\int\frac{dt}{E - z} = \frac{\delta}{k}nt + \frac{\delta' - \delta E}{k}\int_z^{z_2}\frac{dz}{(E - z)\sqrt{2Z}},$$

involving an elliptic integral of the III. kind, and then

$$(29) \qquad \psi = \pi - \chi.$$

* *Proc. London Math. Society*, XXVI., XXVII.

But the component of the angular momentum round the vertical

$$(30) \qquad OC\cos\vartheta + CK\sin\vartheta = G'\cos\vartheta + A_1\sin^2\vartheta\,\frac{d\psi}{dt} = G$$

so that

$$(31) \qquad \frac{d\psi}{dt} = \frac{G - G'\cos\vartheta}{A_1\sin^2\vartheta} = \frac{G - G'z}{A_1(1-z^2)} = \frac{G-G'}{2A_1}\cdot\frac{1}{1-z} + \frac{G+G'}{2A_1}\cdot\frac{1}{1+z},$$

which gives ψ as the sum of two elliptic integrals of the III. kind, their addition into a single integral (Legendre) is shown by (28), (29).

The reduction to the Weierstrassian form is effected by putting

$$(32) \qquad p\mu - e_a = s - s_a = \tfrac{1}{2}M^2(z - z_a),$$

where M is a homogeneity factor at our disposal; and now

$$(33) \qquad nt = \int_{s_2}^{s}\frac{M\,ds}{\sqrt{S}}, \quad S = 4(s-s_1)(s-s_2)(s-s_3),$$

$$(34) \qquad p'^2\mu = S = \tfrac{1}{2}M^6 Z,$$

$$(35) \qquad \frac{nt}{M} = \int_{s}^{\infty}\frac{ds}{\sqrt{S}} - \int_{s_2}^{\infty}\frac{ds}{\sqrt{S}} = \mu - \omega_2.$$

If v, σ, Σ denote the corresponding values of μ, s, S when $z = E$,

$$(36) \qquad pv - p\mu = \tfrac{1}{2}M^2(E - z)$$

$$(37) \qquad pv - e_a = \sigma - s_a = \tfrac{1}{2}M^2(E - z_a)$$

$$(38) \qquad ip'v = -\sqrt{(-\Sigma)} = M^3\frac{\delta' - \delta E}{k},$$

$$(39) \qquad z_1 > E > z_2 > z > z_3, \quad s_1 > \sigma > s_2 > s > s_3,$$

so that

$$v = \omega_1 + \psi\omega_3;$$

and (28) becomes

$$(40) \qquad \pi = \frac{\delta}{k}nt + \tfrac{1}{2}\int\frac{ip'v\,dn}{pv - p\mu},$$

with the elliptic integral of the III. kind in the standard form of Weierstrass.

In the steady motion of the top, $\frac{d\vartheta}{dt} = 0$, $\frac{d\psi}{dt} = \mu$, a constant, H and K coincide, and

$$(41) \qquad \rho = GK = OC\sin\vartheta - CK\sin\vartheta = G'\sin\vartheta - A_1\mu\sin\vartheta\cos\vartheta,$$

$$(42) \qquad Wgh\sin\vartheta = \rho\mu = \sin\vartheta\,(G'\mu - A_1\mu^2\cos\vartheta),$$

and dropping the factor $\sin\vartheta$,

$$(43) \qquad A_1\mu^2\cos\vartheta - G'\mu + Wgh = 0.$$

A. G. GREENHILL.

ORDNANCE COLLEGE,
WOOLWICH, ENG.

CURRENT NOTES ON PHYSIOGRAPHY.

NEW ORDNANCE MAP OF ENGLAND.

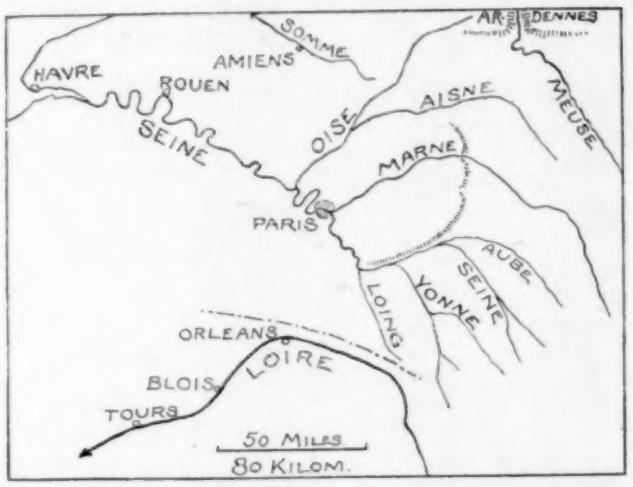
THE 'Colored One-inch Map of England,' now in process of publication, marks a great improvement on both the old and the new series of the earlier ordnance survey inch-to-a mile maps. Relief is shown by brown hachures, drawn with much accuracy of expression, and by red contours at intervals of 100 feet. Water is in blue, with blue contours in the sea for every 25 feet of depth near shore; the chief roads are in ochre, woodland on some of the sheets is green, and culture is black. Most of the sheets represent quadrangles measuring 18 miles east and west by 12 miles north and south; but for southern England the sheets frequently include larger areas, according to some system that is not immediately apparent. Some 130 sheets have now been published, the standard sheets costing a shilling each. While looking over them, local geographical features are brought vividly to mind. The Falmouth sheet, Cornwall, includes the typical drowned valleys of Fal and Helston rivers, open to the sea on the east side of the even uplands back of the Lizard, and of Loe river, closed on the more exposed western coast by Portleven sands, one of the few beaches of this ragged shore line. The contours along the valley sides here and on the neighboring Ivybridge and Boscastel sheets are of much smoother curvature than those that follow the coast, thus showing that the shore line in this district of resistant ancient rocks is in that immature stage of development when its irregularity of detail has become greater than it was in the initial stage. Where the coast consists of weaker Mesozoic rocks, as shown on the Exeter and Sidmouth sheets, a smoother shore line of greater retreat and more mature express sion is found. A little further east, where the Bridport and Weymouth sheets join, the long sweeping curve of Chesil bank is finely displayed.

The relations of rivers to their valleys offer some interesting problems. In certain meandering valleys the rivers sweep around the valley curves in a most competent fashion, pressing against their outer banks and demanding an increased breadth of meander belt; the Torridge in Devonshire (Chulmleigh sheet) and the

Tamar in Cornwall (Tavistock sheet) are of this kind. But it is more common to find the streams incompetent to swing steadily around the curves of their meandering valley floors; the headwaters of the Thames in the Cotswolds offer striking illustrations of this sort. The Evenlode (Oxford sheet) and the Cherwell (Chipping Norton sheet) are typical straggling streams, meandering on so much smaller a scale than their valley that they seem to wander aimlessly about its curving floor. The chief cause of the incompetence of these streams is probably to be found in their loss of volume, from having been beheaded by the (Stratford) Avon; yet some additional cause must be looked for, inasmuch as the Avon, which should be gaining in volume as its obsequent branches increase in length with the retreat of the Cotswold escarpment, is also somewhat incompetent to follow the pattern of its distinctly meandering valley (Worcester and Stratford-on-Avon sheets). No general climatic change towards less rainfall can be appealed to, for the streams cited in Cornwall and Devonshire, as well as certain others in Wales, show no signs of diminished volume by shrinking from the curvature of their valleys. The meanders of the Torridge, above mentioned, are remarkable for their large arc, and for the associated interlocking or dovetailing of the upland spurs that enter the valley meanders. The spurs that enter the meanders of the Evenlode valley appear to have been trimmed and steepened on their up-valley side, the result of the systematic down-valley migration of the river meanders before the decrease of volume took place; the distinctness with which this delicate detail of form is shown being a high tribute to the accuracy of the topographer's work.

HYDROGRAPHY OF THE PARIS BASIN.

The geological structure of the Paris basin has been minutely studied by Dollfus, who makes application of his results in a discussion of the 'Relations entre la structure géologique du bassin de Paris et son hydrographie' (*Ann. de Géogr.*, XI., 1900, 313–339, 413–435, map). The Cretaceous and Tertiary strata that occupy most of the basin have been gently undulated in late Tertiary or in post-Tertiary time; the shallow synclines and low anticlines generally run northwest-southeast, in accordance with the trend of the more closely folded underlying Paleozoic strata, which appear in Brittany and elsewhere. The author recognizes several classes of streams: consequent, inconsequent, obsequent (the definition of this term does not agree with that given by others) and secant (traversing an anticline); subsequent streams are not explicitly noted. He then shows that many streams of the Paris basin are consequent, inasmuch as they follow synclinal troughs. The Somme is a good example of this class, although it does not drain the whole length of its syncline (p. 317). The eastern part of the syncline is occupied by the Aisne, which is led southward



by the Oise, away from what appears to have been its original westward extension to the Somme; the Oise being secant to several anticlines on its way to the Seine just below Paris. This diversion is ascribed to capture (p. 318), though the causes and proofs of capture are not clearly set forth. The diversion might possibly be consequent on a rise in the floor of the syncline between the Oise and the head of the Somme.

While many examples of consequent synclinal streams are indicated, they are usually of relatively small volume. A number of the larger streams frequently follow oblique courses, seemingly indifferent to the anticlines that lie across their way, and for this inconsequent behavior no full explanation is offered. The antecedent origin of the Meuse through the Ardennes is discarded (p. 330) on what seems insufficient evidence; its gorge is explained as the result

of retrogressive erosion by a Belgian stream, which is thought to have captured the Meuse from an assumed westward course south of the uplands, a process that seems inadmissible in view of the continuity of the Ardennes as a divide elsewhere. The numerous subsequent streams in the eastern part of the Seine system are not recognized as such; and the subsequent valley-lowlands, opened on weak strata, between the cuestas that are maintained by stronger strata, are not regarded as certainly due to differential erosion (p. 326), although no specific reasons are given to justify this scepticism. The Loire, whose former northward course from the Central plateau to the Seine is proved by the distribution of crystalline gravels, is explained as having been turned to its present westward course past the site of Orleans by one of the chief anticlines of the region; but its extension southwest past Blois and Tours seems to have been taken with little regard to the numerous anticlinal and synclinal axes mapped there.

The former northward course of the Loire, as above stated, may perhaps give explanation to the peculiar westward deflection of the Aube, upper Seine and Yonne along a subsequent valley south of the cuesta of *calcaire grossier* to the point where the Loing, a smaller stream, turns their united waters through the cuesta towards Paris. The Loing seems to represent the former course of the Loire. While that large river ran here, one of its subsequent branches might, with more or less aid from differential elevation, naturally enough have captured the Yonne, upper Seine and Aube, which then continued in their deflected course after the Loire had been turned away to the west.

HERCEGOVINA.

A students' excursion from the University of Vienna through Bosnia, Hercegovina and Dalmatia, under Penck's leadership, in the spring of 1899, led that geographer to prepare two essays on the physical features of the region visited ('Geomorphologische Studien aus der Hercegovina,' *Zeitschr. deutsch.-oesterr. Alpenvereins*, XXXI., 1900, 25–41, 'Die Eiszeit auf der Balkenhalbinsel,' *Globus*, LXXVIII., 1900, 133–136, 159–164, 173–178). Strongly folded Mesozoic limestones occupy most of the country traversed. They have been extensively denuded and in some areas reduced to plains, while elsewhere mountains of strong relief still remain. Some of the latter possess well-defined cirques and moraines of former local glaciers. Large sinkholes abound in the highlands. Much of the upland surface exhibited bare limestone ledges, the typical Karst landscape. The lower course of the Kerka river lies across one of the plains of denudation whose surface evenly truncates the inclined limestone strata; but the plain is now elevated and trenched by the river, and in the young gorge thus formed extensive travertine deposits have produced a beautiful group of falls, back of which stretches a narrow, branching lake. In other cases, dislocation is believed to have accompanied elevation. Many streams that flowed on the surface of the lowlands before their elevation now escape to the sea from enclosed basins by underground passages, reappearing further on in great springs, and thus leaving the uplifted land forms more than usually intact. The undersigned also, as a member of Penck's party, has written a brief account of this 'Excursion in Bosnia, Hercegovina and Dalmatia' (*Bull. Geogr. Soc. Phila.*, III., 1901, 21–50).

W. M. DAVIS.

NOTES ON ENTOMOLOGY.

WITH the coming of the new century we have two new entomological journals. One, entitled *Revue Russe d'Entomologie*, is issued bimonthly by a committee of six editors, several of whom are well known to entomologists. It is a general journal, containing descriptions of new species, synopses, etc., but most of the articles are devoted to the Russian fauna. Each number contains a bibliography of current entomologic literature appertaining to the Russian fauna. The other journal is the *Zeitschrift für systematische Hymenopterologie und Dipterologie*, published by F. W. Konow, of Teschendorf, Germany. Six numbers are to appear each year. Its title indicates its intended scope, but several biologic articles have already appeared in its pages.

It has long been known that the species of *Orina*, a genus of Chrysomelid beetles, were viviparous. Recently Mr. Champion and Dr.

Chapman have investigated this matter,* confirming the previous knowledge, and discovering that one species is ovo-viviparous. They find that the eggs develop into larvæ in the ovarian tubules, and increase in size during their progress down the oviduct. This indicates that fecundation in these insects is not by the usual method; but how is as yet unknown.

Part I., 1901, of the journal of the Hungarian National Museum, *Természetrajzi Füzetek*, contains world catalogues of two families of insects. One is 'Catalogus Pipunculidarum,' by C. Kertész, pp. 157–168. It brings the subject down to 1901, and includes 4 genera and 110 species. The other is a 'Catalogus Endomychidarum,' by E. Csiki. It is published as a supplement to the journal, and contains 78 genera and 585 species.

Brauer has issued another part of his 'Beiträge zur Kenntniss der *Muscaria schizometopia*.'† This deals with the synonomy of many species described by Bigot, Macquart and others that belong to genera allied to *Calliphora*. It is prefixed by a table to these genera. Nearly twenty of the species come from the United States, and many more from Mexico. Of especial value are his determinations of the Bigot material.

E. Wasmann has concluded his paper on '*Termitoxenia*,'‡ in which he deals with the systematic position of the genus. In a previous part he thought it would go in the Stethopathidæ, but now he concludes to erect for it a new family, Termitoxenidæ, intermediate between the Eumyidæ and the Pupipara. It thus falls into Coquillett's superfamily Muscoidea.

An interesting contribution towards the life-history of an eastern mosquito has been published by Miss Nelly Evans.§ She has studied *Culex fatigans*, one of the species known to attack birds. Specimens were kept a month on fruit; but will not deposit eggs until they have had a meal of blood. Fertilization normally occurs after feeding, but one specimen laid eggs that had been fertilized only before feeding. Egg-boats are laid about four to six days after meal of blood; if the mosquito is again fed, it will deposit again, and some specimens laid five egg-boats. The larval stage lasts twenty days; the pupal stage four days.

Dr. F. Dahl has given an account of the habits of the ants of the Bismarck archipelago.* It is preceded by a systematic article by Professor Forel. Dahl, however, gives tables to the genera and species, both according to structure, and according to nesting habits. He compares the fauna to that of north Germany, and tabulates the species of the latter region according to nest habits. The plates illustrate two remarkable nests. One is of *Camponotus quadriceps* in the stems of a plant. The pith is partially excavated; at places the cavity is enlarged, and there are simple openings to the outside. This does not affect the plant or cause any abnormal growth. The other is a greatly enlarged stem of a plant in which there are many channels and cavities caused by *Iridomyrmex cordatus*.

Dr. G. Enderlein has written on the breathing apparatus of the Gastridæ† (more commonly known as Œstridæ). In these larvæ, which infest various large animals, respiration is often performed under difficulties, and results in considerable modification of the breathing apparatus. These modifications, which the author describes in considerable detail, are summed up as follows:

1. Complication of the closing apparatus of the stigmata.
2. Elongation of the stigmal cleft.
3. The beginning of air reservoirs.
4. Development of the terminal tracheal structures for the reception of oxygen by the blood.

* 'Observations on some Species of *Orina*, a Genus of Viviparous and Ovo-viviparous Beetles,' *Trans. Ent. Soc., Lond.*, 1901, pp. 1–19. 2 plates.

† *Sitzungsber. Akad. Wissensch.*, Wien, 1899 (1901), pp. 495–529.

‡ '*Termitoxenia*, ein neues, flugelloses, physogastres Dipterengenus aus Termitennestern'; part II. *Zeitschr. f. Wissensch. Zool.*, 1901.

§ 'Some Observations on the Life-history of *Culex fatigans*, the Common Grey Mosquito of Lower Bengal,' *Proc. Asiat. Soc. Bengal*, Aug., 1901, pp. 65–67.

* 'Das Leben der Ameisen im Bismarck-Archipel,' *Mitt. Zool. Mus. Berlin*, II., hft. 1, pp. 1–70, 2 pls., 1901.

† 'Die Respirationorgane der Gastriden,' *Sitzungsber. Akad. Wiss.*, Wien, May, 1899 (1901), pp. 235–302, 3 pls.

Karl Verhoeff has recently added another number to his series of articles on palæarctic Myriopods.* This part deals with certain points in the morphology, classification and distribution of the Chilopoda. He makes out four pairs of mouth-parts, and five segments in the chilopod head. The systematic part treats of the genera *Bothriogaster*, *Geophilus*, *Cryptops* and *Lithobius*.

Probably no one has studied the varieties of a moth so closely as has Mr. J. A. Clark, who, in a recent article on '*Peronea cristata* Fabr. and its aberrations,'† has elucidated and named no less than sixty-two forms of this British moth. Twenty-five of these aberrations are here described for the first time.

Monographiæ Entomologicæ, No. II., is to be 'A Monograph of the Membracidæ' of the world, by G. W. Buckton. The first part has been issued, is a quarto in size, and contains fifty-six pages and eight colored plates. It is, however, far from a 'monograph'; there are descriptions of many species, but there are many other species listed but not described, and often without reference as to where they were described. One of the new species is from New York. The plates are rather crude.

Every coleopterist should be interested in Mr. H. C. Fall's recent list of Coleoptera from southern California.‡ Apart from the fact that, next to the New Jersey list, it is the largest local list yet issued, it is of great value because of the notes on habits and variation of the species mentioned. The total number of species runs up to 2,197, included in 826 genera. The long lists of Malachiidæ and Tenebrionidæ are especially marvelous to an eastern collector. Eighty-seven new species are described, and many others indicated, but not fully studied.

Nuttall and Shipley in continuation of their investigations on the structure and habits of *Anopheles** have given many interesting observations. The recent parts relate to the pupa and imago, and will be of particular value to those interested in the external anatomy of insects. The detailed descriptions of the emergence of the fly from the pupa and of the feeding habits of the imago are especially interesting. In the description of the thorax the authors have followed Brauer in the nomenclature of parts. They consider that the first thoracic spiracle belongs to the mesothorax and not to the prothorax, as several authors have claimed.

Major Ross has issued his 'First Progress Report of the Campaign against Mosquitoes in Sierra Leone.'† This crusade was largely in the nature of an experiment to prove that tropical towns, notorious for mosquitoes and malaria, could be largely freed from these plagues by the adoption of certain sanitary measures. It is almost needless to say that it was successful. Empty tin cans, buckets and broken bottles were gathered, pools and puddles in streets and back yards were drained, and in a few weeks mosquitoes were rarities in Freetown.

NATHAN BANKS.

* 'Beiträge zur Kenntnis paläarktischer Myriopoden,' XVI., Aufsatz. *Nova. Acta. K. Leop.-Carol. Akad. Naturf.*, LXXVII., No. 5. 1901. 3 plates.

† *Entom. Record*, 1901, pp. 227–229; 261–265; 287–293.

‡ 'List of the Coleoptera of Southern California with Notes on Habits and Distribution and Descriptions of New Species,' *Occ. Papers, Calif. Acad. Sci.*, VIII., Nov., 1901, pp. 1–282.

* 'The Structure and Biology of *Anopheles*,' *Jour. of Hygiene*, I., pp. 259–276; 431–484, 4 pls., 1901.

† Liverpool School of Tropical Medicine, Memoir 5, part 1, 1901.

THE GEOLOGICAL SOCIETY OF AMERICA.

THE fourteenth winter meeting of the Society will be held at Rochester, N. Y., beginning on Tuesday, December 31, in the Geological lecture room, Sibley Hall, University of Rochester. The meeting will be called to order at 10 o'clock a. m. by President Charles D. Walcott. The annual address of the retiring president will probably be given Tuesday evening. The Council will hold an informal session on Monday night to open and count the ballots for officers and fellows, and will meet in formal session at 9 o'clock Tuesday morning. If the weather is favorable short excursions may be planned; one to see the Niagara strata of the Genesee gorge in the northern part of the city, and another to the Pinnacle moraine in the southern edge of the city. Ward's Natural Science Establishment, which is across the street from the University, will provide a lunch

for those Fellows who may wish to visit the Establishment during the noon recess. The president of the University, Dr. Rush Rhees, and the Trustees will tender a reception to the Fellows of the Society at the president's house on Thursday evening, January 2. The customary dinner will be arranged, probably for Wednesday evening.

No special reduction of railroad fare can be secured for the meeting, but during the holiday season reduced rates can usually be obtained from important railroad centers.

PROGRAM OF AMERICAN SOCIETY OF NATURALISTS.

Tuesday, December 31, 1901.

8.00 P. M., Kent Theater, University of Chicago.—Address of welcome, by President W. R. Harper. Lecture by Dr. Leland O. Howard. Subject: 'International Work with Beneficial Insects.'

9.30 P. M., the President's House.—A Reception to all the Societies, by President Harper.

Wednesday, January 1, 1902.

2.00 P. M., Kent Theater.—Business meeting.

3.00 P. M., Kent Theater.—Discussion. Subject: 'The Relation of the American Society of Naturalists to other Scientific Societies.' Charles Sedgwick Minot, Harvard Medical School; C. B. Davenport, University of Chicago; W J McGee, Washington; William Trelease, Washington University, St. Louis; E. A. Birge, University of Wisconsin; J. McKeen Cattell, Columbia University.

6.45 P. M., Auditorium Hotel. — Business meeting.

7.00 P. M., Auditorium Hotel.—Annual dinner. Address of the President, Professor William T. Sedgwick, 'The Modern Subjection of Science and Education to Propaganda.'

LOCAL COMMITTEES.

Executive.—C. B. Davenport, Chairman; E. O. Jordan, Secretary; W. A. Locy, Treasurer; L. F. Barker, C. R. Barnes, John M. Coulter, John Dewey, H. H. Donaldson, G. A. Dorsey, F. R. Lillie, Jacques Loeb, E. P. Lyon, C. O. Whitman.

Reception.—H. H. Donaldson, Chairman; C. W. Andrews, Miss Helen Culver, W. R. Harper, Mrs. Martin A. Ryerson, G. C. Walker, Mrs. Coonly-Ward, C. O. Whitman.

Transportation.—Frederick J. V. Skiff, Chairman; G. A. Dorsey, F. R. Lillie, Willard A. Smith.

General.—C. M. Child, C. B. Davenport, George Dreyer, John Dewey, H. H. Donaldson, G. A. Dorsey, W. S. Hall, L. Hektoen, E. O. Jordan, F. R. Lillie, W. A. Locy, Jacques Loeb, A. P. Matthews, A. R. Reynolds, C. O. Whitman.

RAILROADS.

The New England Passenger Association, the Trunk Line, the Central and the Western Passenger Associations have granted the usual reduction (one and one third fares for the round trip) to those attending the meeting and provided with 'certificates.' The certificates, not transferable, must be obtained from the ticket agent at the starting-point (or, if the starting-point is not an important station, at the nearest station issuing certificates) to the place of meeting, at least thirty minutes before the train leaves. The going ticket may be purchased not earlier than December 26 or later than December 31. The certificate must state that the object of making the journey is to attend the meeting of the Affiliated Scientific Societies at Chicago, and they must be signed on December 31, January 1 or January 2, by Dr. L. W. Williams and by the special railway agent in attendance at the meetings on these three days.

SCIENTIFIC NOTES AND NEWS.

It is announced by cablegram from Stockholm that the Nobel prize in medicine has been awarded to Professor Behring, the prize in physics to Professor Röntgen and the prize in chemistry to Professor Van't Hoff. The value of each of the prizes is about $40,000. The prize for the promotion of peace has been divided between Dr. Dumant and M. Passy, and the prize in literature has been awarded to M. Prudhomme.

The Symons gold medal of the Royal Meteorological Society has been awarded to Dr. Alexander Buchan, F.R.S.

PROFESSOR ALFRED C. HADDON, of Cambridge University, lectured before the New York Academy of Sciences and the American Ethnological Society on December 11, his subject being 'The Ethnography of British New Guinea.' Professor Haddon sailed for England on December 14.

THE Academy of Natural Sciences of Philadelphia, has nominated Professor E. G. Conklin, of the Biological Department of the University of Pennsylvania, for vice-president; and Dr. J. P. Moore, of the same department, for corresponding secretary.

SIR WILLIAM ROBERTS-AUSTEN, K.C.B., F.R.S., will deliver the tenth 'James Forrest' lecture at the Institution of Civil Engineers on April 17, 1902, the subject being 'Metallurgy in Relation to Engineering.'

DR. N. SIEBER-SCHUMOW, a woman, has been temporarily appointed to fill the place of the late Professor Nencki as head of the Department of Biological Chemistry in the Imperial Institute of Experimental Medicine, St. Petersburg.

THE Board of Overseers of Harvard College has voted that 'a joint committee of the corporation and this board be appointed to confer with Mr. Alexander Agassiz and request him to sit for a portrait to be placed in the museum as a gift from friends of his and of the university, there to remain a memorial of the great service rendered by Professor Agassiz to that department.'

AN oil painting of Professor John Johnson, LL.D., who was professor of natural science at Wesleyan University from 1837 to 1879, has been presented to the library.

As a memorial of the late Professor Dickson, there have been presented to the Glasgow University library 388 volumes of Migne's 'Pathology,' a work which Dr. Dickson long desired to acquire for the library.

A PORTRAIT of Mr. G. D. Liveing, professor of chemistry at Cambridge University, was presented to St. John's College on December 7, as a testimonial in recognition of his valuable services to science, to the university and to the town. The portrait, which is by Sir George Reid, is of three quarters length. Arrangements have also been made for a bronze bust of Professor Liveing, by Miss Edith Bateson, which will be placed in the chemical laboratory during next year.

DR. CHARLES J. ESSIG, professor in the dental department of the University of Pennsylvania, has died at the age of seventy-four years. In 1878 he organized the dental department of the University of Pennsylvania, and was for many years its dean and secretary. He was the editor of 'The American Text-Book of Prosthetic Dentistry,' and the author of a well-known treatise on dental metallurgy.

MR. WILLIAM RICH HUTTON, a well-known civil engineer, died on December 11 at the age of seventy-five. He was a member of the American Society of Civil Engineers, the Institution of Civil Engineers of London and of the Société des Ingénieurs Civils de France.

MISS H. M. GOULD has given $5,000 to New York University for the establishment of a museum of pedagogy, with the understanding that this should be applied in the first place to an exhibit of the work done for education by New York University, and that this should form an exhibit at the World's Fair at St. Louis in 1903, and afterwards become the property of the School of Pedagogy.

THE Association of American Universities will hold its annual meeting at Chicago, during the last week of February next.

AN election for officers of the Botanical Section of the Academy of Natural Sciences of Philadephia, December 9, 1901, resulted in the choice of the following persons: *Director*, Benj. H. Smith; *Vice-Director*, Joseph Crawford; *Corresponding Secretary*, John T. Pennypacker; *Recorder*, John W. Harshberger; *Treasurer and Curator*, Stewardson Brown; *Directors*, Benj. H. Smith, Joseph Crawford, Stewardson Brown, Ida A. Keller, John T. Pennypacker.

MR. FREDERIC A. LUCAS, curator of the Division of Comparative Anatomy at the U. S. National Museum, lectured before the Woman's College of Baltimore, December 3, on 'Dinosauria.' Sir Robert Ball, of the University of Cambridge, Eng., lectured on December 6, his subject being 'Other Worlds than Ours.'

Among the lecturers before the Technology Club of the Massachusetts Institute are Dr. Ira Remsen, president of the Johns Hopkins University (Dec. 12); Professor George E. Hale, director of the Yerkes Observatory (Jan. 3); Professor Arthur A. Noyse (Feb. 18); Mr. William Barclay Parsons, chief engineer of the New York subway (Feb. 26); Mr. F. H. Newell, chief hydrographer, United States Geological Survey (Mar. 3).

Three additional lectures on archeology have been arranged for December at the University of Pennsylvania. The first one will be on 'The Archeology of Michigan,' by Mr. Harlan I. Smith, of the American Museum of Natural History, New York. The second by Stewart Culin on 'Archeological Notes on the John Wanamaker Expedition of 1901.' The last lecture before the holidays will be on 'The Cliff Dwellers and their Relations,' by Dr. J. Walter Fewkes, of the United States Bureau of Ethnology, Washington, D. C.

It is announced that Boothia Felix has been chosen as the headquarters for Professor Amundsen's three-year magnetic pole expedition. Boothia Felix is a peninsula, and is the most northern part of the mainland of North America, having east, Boothia Gulf; north, Bellot Strait, and west, Franklin Channel. The magnetic pole is in this peninsula, the northern point of which is in about latitude 72 degrees north.

An assistant is wanted for the respiration calorimeter experiments and other nutrition investigations in the chemical laboratory of Wesleyan University and for work in the collating of results of foreign inquiry and preparing reports for publication. A chemist or physiologist, or better, a physiological chemist, of university training, preferably a Ph.D. or M.D., is desired. Scholarly spirit, ability for independent research, familiarity with German, French and other chemical and physiological literature, or, at least, the capability of becoming familiar with such literature are important. A man capable of becoming a university professor or director of a scientific establishment is desired. The salary at the outset will be from $1,000 to $1,500, according to the qualifications, with the chance of increase to that of an associate professorship or professorship. There may also be a second position for a man of similar abilities and academic training but with less experience and correspondingly smaller salary, very probably the equivalent of a fellowship, with opportunities for study and advancement. The work is connected with the inquiries regarding the food and nutrition of man which is being carried on under the auspices of the U. S. Government in universities, colleges and experiment stations in all parts of the country and has its headquarters at Wesleyan University. The association with a number of trained specialists, the atmosphere of research, unusual library facilities and opportunity for experimental inquiry, study and advancement make the positions very desirable for young and ambitious men. Applications for either of the above positions may be made to Professor W. O. Atwater, Wesleyan University, Middletown, Conn.

The United States Geological Survey has in press a work entitled 'Bibliography and Catalogue of the Fossil Vertebrates of North America,' by O. P. Hay. It contains a list of about 4,100 papers which bear on the fossil vertebrates of North America and a systematic list of all the species that have been described. Furthermore, there goes with each species citations of all the works in which it has been described and discussed. An estimate shows that there are altogether about 40,000 citations. The book forms bulletin No. 179 of the Survey, and will be issued probably early in the coming year.

Henry S. Carhart, professor of physics in the University of Michigan, and Horatio N. Chute, instructor in physics in the Ann Arbor high school, are writing a new work on physics, which will be completed in about two months. The work will be called 'High School Physics.'

The London *Times* states that Dr. Charles Balfour Stewart has proceeded to Sierra Leone under the auspices of the Liverpool School of Tropical Medicine to study the methods successfully utilized by Dr. Logan Taylor in dealing with malaria. Dr. Balfour Stewart has had considerable experience in India, and the knowledge he there acquired proved very ser-

viceable on the recent appearance of plague in Liverpool. Now he intends to commence his attack on malaria at Cape Coast Castle, where there is great mortality among Europeans. Under Major Ross he will have the general direction of operations for improving the drainage and general sanitary conditions of Cape Coast Castle, clearing away the stagnant pools which are breeding-places for the *Anopheles* mosquito. Though Dr. Balfour Stewart has been engaged for a year by the Liverpool School of Tropical Medicine, he will, it is expected, remain on the West Coast while his help is needed to place the sanitary conditions of the colony on a satisfactory basis. He also contemplates operations in the mining districts, but will be guided by the advice of the Governor of the Gold Coast. Thus the sanitary crusade against malaria will shortly be in operation on the whole coast from the Gambia to Lagos.

MR. A. MONTEFIORE PRICE writes to the London *Times* as follows: "Now that the more serious work of the British Association is over it may perhaps interest your readers if I draw attention to some curious examples of science adapted to heraldry. I derive them from the banners and bannerets which have been hanging up in the reception room of the British Association at Glasgow during the past week. The banner, for example, of Sir William Huggins, who was president at the Cardiff meeting, 1891, shows the solar spectrum for a crest and the constellation of Orion for a coat of arms. That of Sir William Crookes presents a radiometer and three prisms, together with the quaint motto 'Ubi crux ibi lux.' Herschel was president of the meeting at Cambridge so long ago as 1845, and on his arms there appropriately appear the sun in the chief and a telescope in the base. Sir William Turner, who presided last year at Bradford, bears as a charge a wheel; Siemens blazons what is aparently a beetroot—he was interested, I believe, in sugar produced from that source, and Sir Roderick Murchison, who was president at Southampton so long ago as 1848, a pecten shell—suitably enough for so a great geologist. Sir William Flower's banner shows a coat bearing a cinquefoil and the punning motto 'Et flores et fruches.' Lord Lister (Liverpool, 1895) blazons the staff and serpent or Æsculapius; Dawson, who presided at Birmingham in 1886, has three daws on his coat; and Sir George Airy (Ipswich, 1851), Sir Henry Roscoe (Manchester), and Sir Michael Foster (Dover) display the arms of those towns and presumably did not possess personal arms."

WE learn from the London *Times* that the business and finance committee of the general council of Edinburgh University has prepared a report on the subject of the Carnegie Trust. It says that chairs in the University founded long ago embrace nominally many subjects which, if they are to be followed beyond their elementary stages cannot profitably be now taught by one man. It may be possible for a professor to give systematic instruction over the whole subject to ordinary students, but for the purpose of higher study and research by the professor and the advanced students there is now great urgency, if not for splitting up the subject, at least for the creation of junior associate professorships to relieve the pressure and to enable more personal practical instruction to be given to the students. Any such professorships instituted by the Carnegie Trust might, therefore, with great advantage be attached to the four universities in common, subject to some new arrangement. Many benefits, besides the obvious one of economy, would accrue from the introduction of community and reciprocity as working ideas into Scottish university life. One of the foremost claims upon the trustees will be to strengthen the modern language departments in each of the universities. Traveling scholarships would be a great incentive and benefit to students. Research in medicine and science demands a large portion of the immediately available income in the hands of the Carnegie trustees. What have been required for long are special research laboratories in which higher students would in the first instance be trained in the methods and apparatus of research. Mr. Carnegie's position as a founder of libraries is a guarantee that the University libraries will receive adequate consideration at the hands of the trustees. With regard to the payment of University class fees the report says that the scheme should give a great impetus to education throughout the country. Some such

stimulus has been needed, as of late the number of university students has tended to decrease. The committee further presents an interim report on the decrease of students pending a fuller investigation which is to include the other Scottish universities and English and foreign schools. In Edinburgh the number of students continuously decreased from 3,576 in 1889–90 to 2,825 in 1895–96, above and below which figure they have fluctuated but slightly.

THE Royal British Commission on Tuberculosis is now sitting in London. The experimental part of its work will be carried out near Stansted, in Essex, on two farms that have been placed at the disposal of the commission by Sir James Blyth.

UNIVERSITY AND EDUCATIONAL NEWS.

MR. JOHN D. ROCKEFELLER, has made a further gift of $1,250,000 to the University of Chicago, making the total amount given by him $10,251,000.

BY the recent death of Mrs. Anne Wentworth, of Lowell, Mass., Dartmouth College will, it is said, come into the possession of an estate worth about $500,000, bequeathed to it by Tappan Wentworth.

WESLEYAN UNIVERSITY has secured $100,000 which will be used for an administration building, and $25,000 toward a fund for the building of an observatory and scientific laboratories.

IT is reported that Mr. Carnegie will liberally endow the Carnegie Laboratory of Engineering of the Stevens Institute on the occasion of the dedication on February 6.

DR. PURDIE, professor of chemistry in St. Andrews University, has offered the University a gift of £5,000 for the purpose of building and equipping a small chemical research department at St. Andrews. In his letter to Principal Donaldson intimating the gift, Professor Purdie says that their universities are very poorly provided for research when compared with those of foreign countries, and that scientific industries suffer in consequence.

THE physical laboratory of the University of Michigan will be enlarged next year by taking in the third floor of the building, which has hitherto been devoted to bacteriology, and possibly by the addition of a large lecture room to seat 300 persons. The present capacity of the building is insufficient to accommodate the 500 students who are taking courses in physics.

FIRE of unknown origin destroyed the main building of the University of Wooster. The loss is estimated at $250,000, with insurance of about $70,000. It is supposed that an explosion of chemicals in one of the laboratories was the cause.

THE registration at the Sheffield Scientific School of Yale University this year and last is as follows:

	1900–1901	1901–1902
Graduate Students	105	133
Seniors	134	128
Juniors	143	143
Freshmen	199	245
Special Students	29	26
	610	675

There is thus an increase of 65 students, especially noticeable being the increase in the number of graduate students and of the Freshman class.

The number of dental students in America from foreign countries is increasing every year. In the dental department of the University of Pennsylvania this year 80 of the 364 registered students are foreigners, representing a large number of nationalities.

MR. JOHN A. BRASHEAR has been elected Chancellor of the University of Western Pennsylvania. Mr. Brashear was last year vice-president of the American Association for the Advancement of Science and chairman of the Section of Mechanical Science and Engineering.

DR. HENRY LEFAVOUR, professor of physics at Williams College, and dean of the faculty, has been elected president of the newly-organized Simmons College for Women at Boston.

PROFESSOR E. G. HARRIS, of the Missouri School of Mines, has been elected professor of civil engineering in the University of Pennsylvania.

DR. THEODORE W. RICHARDS has been elected full professor of chemistry at Harvard University. It will be remembered that Professor Richards was recently called to a chair of chemistry at Göttingen.